CIVIL ENGINEERING

THE MAGAZINE OF ENGINEERED CONSTRUCTION • OCTOBER 1961

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Owners: Board of Harbor Commissioners, Wilmington, Del. Engineers: Modjeski & Masters; Contractor: Newark Construction Company. (Piling driven in 1933 by Thos. Earle & Son, Inc., Philadelphia.)

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This simple nuclear compaction test can save you $23,000 a year

A NATIONWIDE SURVEY of 1,200 large road-building and earth-moving contractors revealed that compaction equipment dead-time, call-backs, and lost man-hours cost them an average of $23,000 a year. They reported reluctance to move equipment and crews down the job until inspectors had okayed compaction. (Copies of this survey are available on request.)

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See the d/m-Gauge in operation at the A.S.C.E. convention, October 16-20, New York City, Statler-Hilton Hotel, Booth 67.

Write to receive your copy of this new application and specification booklet or to request a demonstration.

nuclear-chicago
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A dual-purpose traffic marker . . . of scored white concrete made with ATLAS WHITE portland cement. By day, its whiteness stands out in sharp contrast to the adjacent pavement, clearly outlining the lane ahead. By night, its ribbed surface catches headlight beams and reflects them back to the driver, forming a visible ribbon of white. On rainy nights, the marker becomes even more reflective. In addition, when tires ride the corrugated surface, a distinct "humming" sound is heard, warning the driver that he is veering out of lane. For more details on the construction of this highway safety feature, write: Universal Atlas, 100 Park Avenue, New York 17, N. Y.

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C-40

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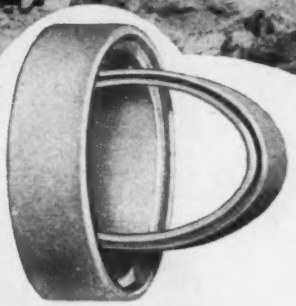

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LO-HED® PIPE

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no leaks in them joints"

U.S. cast iron PIPE FOR WATER, SEWERAGE AND

not a leak in a lakeful!

The joints on USIFLEX® Boltless Flexible Joint Pipe are bottle-tight. Joint is made up with a moderate thrust to move ball past self-sealing gasket in socket. Rugged retainer ring locks joint against pull-out during installation and in service. And no wrenches, bolts or nuts to worry about.

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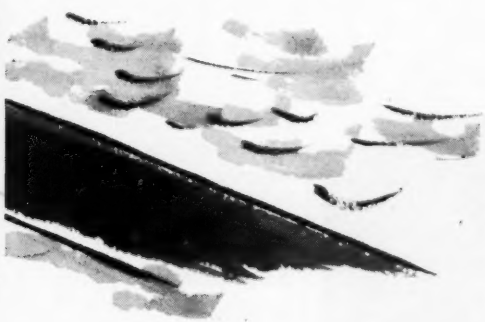

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BOLTLESS FLEXIBLE JOINT* PIPE

*U. S. Patent No. 2,564,938

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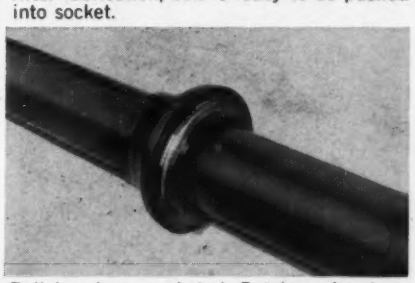
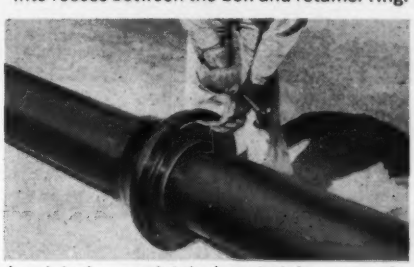
1 Insert the gasket in its seat in the socket. Forming gasket loop helps initial stage of seating. Release of loop allows gasket to spring into the gasket seat where it is securely held.

2 Apply special Usiflex lubricant to the ball and inside surface of seated gasket in socket. After lubrication, ball is ready to be pushed into socket.



3 Ball has been socketed. Retainer ring lugs have been lined up with recesses in bell and retainer ring is ready to be moved into the bell and rotated.

4 After insertion and rotation of retainer ring in bell, the lugs on retainer ring are in back of and in register with internal flange segments in bell. Lead lock is partially inserted into recess between the bell and retainer ring.



5 Lead lock completely inserted in recess is being caulked in place by hammer blows on a wide caulking iron.

Built for engineers— by Turner

This is the gleaming new "capitol" for America's engineers, standing on the northwest corner of United Nations Plaza in New York City. Here, for the first time in engineering history, 19 leading engineering societies and agencies will work together under one roof.

The high purpose of this building has been clearly expressed by the Honorary Chairman of the Society, former President Herbert Hoover: "Among engineers there must be a constant exchange of discovery, improvements and experience. This great building is to facilitate these goals. It will play a great part in American life . . . serve all mankind."

Turner is especially gratified to have been selected to erect the United Engineering Center. As a point of fact, over the years many organizations intimately connected with the construction industry have chosen Turner time and again when they decided to build.

Architects: Shreve, Lamb & Harmon Associates

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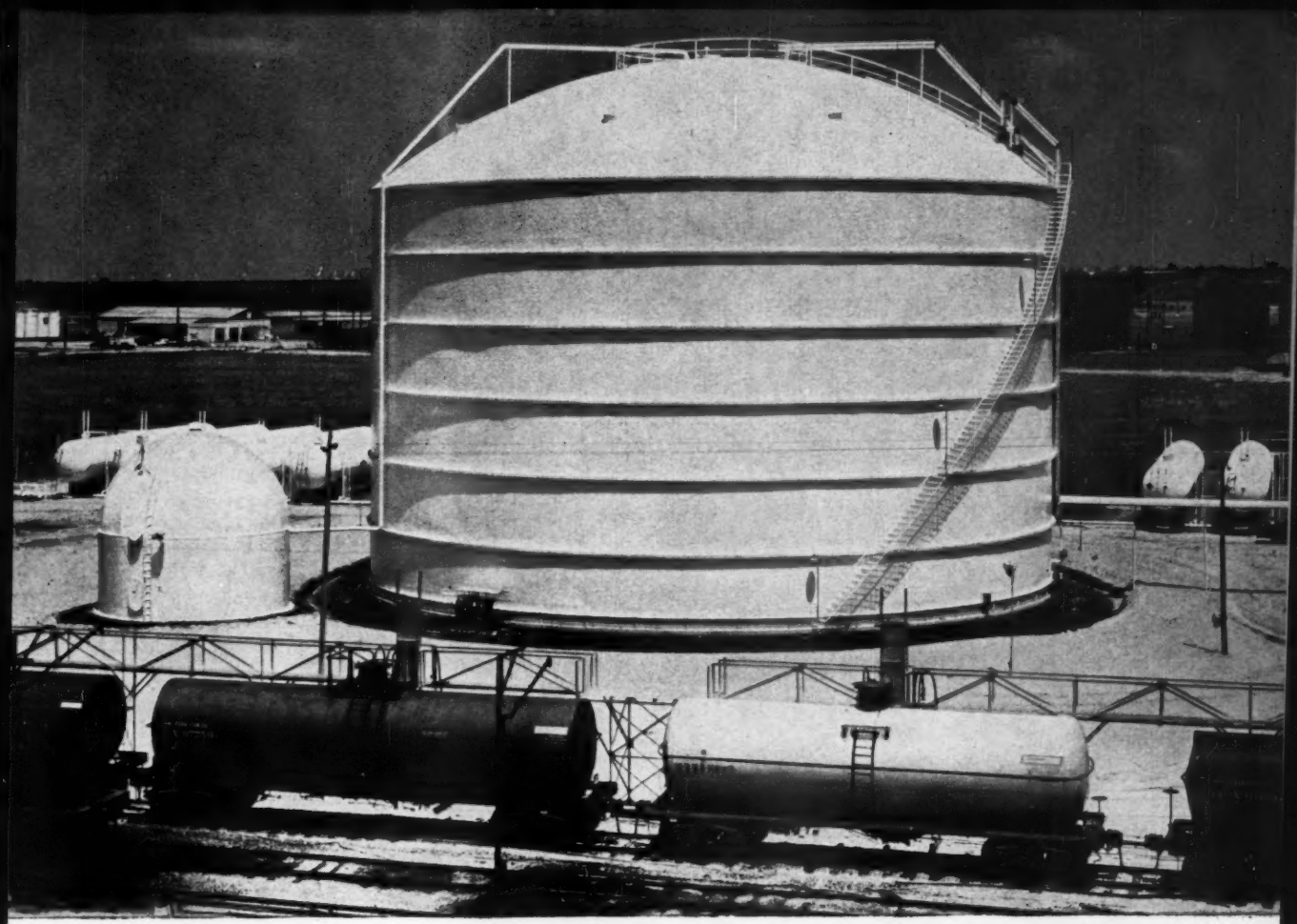


Another Cost-Saving Triumph for Refrigerated Storage of Anhydrous Ammonia

The key to efficient, economical storage of anhydrous ammonia at the Mid-South Chemical Co., plant in Memphis, Tenn., is this refrigerated storage facility designed and built by CB&I.

The economy of refrigerated storage facilities operating at atmospheric pressure (including operating and maintenance cost) has been proved many times in comparison with conventional pressure storage at ambient temperatures. Inherent safety features are built into the facilities.

This same economic benefit is available for "peak shaving" storage of liquefied petroleum gas and for gas production plants.

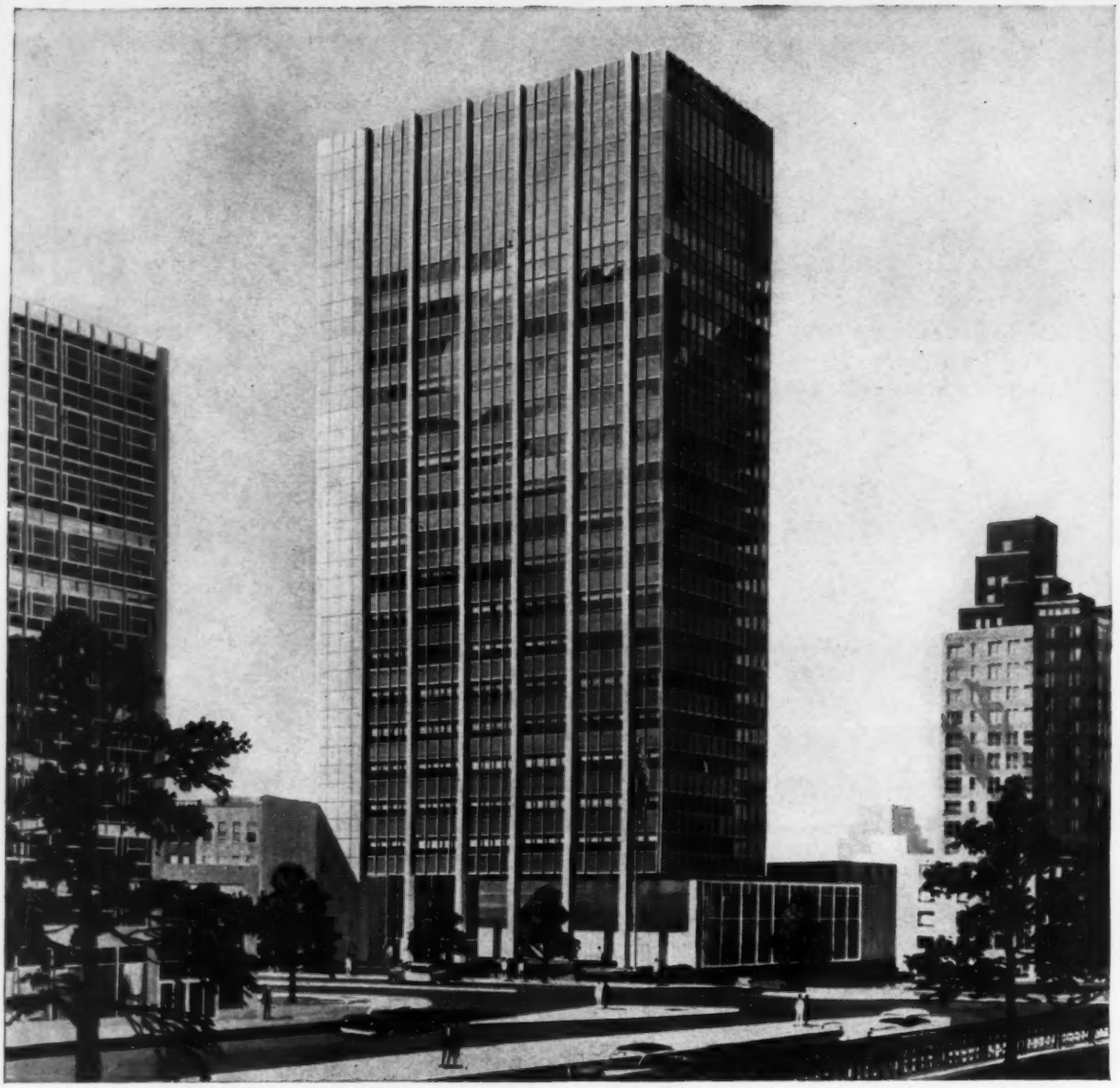
Single Responsibility is assured —from initial planning through all phases of designing, engineering, fabricating and constructing— when you choose CB&I to build your refrigerated storage facility.

As the leading designer of low-temperature storage facilities, CB&I has considerable information that can be of value to you. Write for Bulletin G-48. Chicago Bridge & Iron Company, 332 S. Michigan Ave., Chicago 4, Ill. Offices and subsidiaries throughout the world.

The heart of the installation is a 106 ft. dia. double-wall insulated steel tank which stores 9,560 tons (80,000 bbls. water capacity) of anhydrous ammonia at about –27°F. and 0.5 psig. Conventional storage at ambient temperatures would require 136 high-pressure 30,000 gallon blimps. Control is automatic — provided by a combination pneumatic-electrical system.

CB&I **built it!**

CB-6126



LIFETIME GOOD LOOKS—Completed in the summer of 1961, New York's United Engineering Center provides 260,000 square feet gross area for 18 engineering bodies. Exterior of Nickel Stainless Steel and glass will always be easy to maintain. Architects: Shreve, Lamb & Harmon Associates. General Contractor: Turner Construction Company. Nickel Stainless Steel fabricator: Moynahan Bronze Company.

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Now is the time to include Nickel Stainless Steel in *your* plans. Inco will be glad to assist you in every possible way. As a starter, send for the new booklet, "Architect's Guide to Nickel Stainless Flashings." It's free on request, and will make a valuable addition to your reference files.

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"We finished 60 days earlier with Zeecon"

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"By using Econo-Mix, we were able to strip forms in 3 to 5 days, instead of the usual 10," says Contractor W. Douglas Lee. Econo-Mix is a concrete admixture containing Crown Zellerbach's Zeecon, a controlled dispersant.

"The building was ready at least 60 days earlier than it would have been without the admixture, saving $30,000 interest on our financing alone. Finishers were able to start and finish during regular hours, cutting down on costly overtime. Moreover, the Econo-Mix actually paid for itself. We saved at least a half sack or more of cement per cubic yard of concrete.

"**COMPRESSIVE STRENGTH** was well above the 3000 psi requirements.

"**WATER REQUIREMENTS WERE REDUCED** 10 to 15%, making the concrete strong and dense. Yet workability was excellent."

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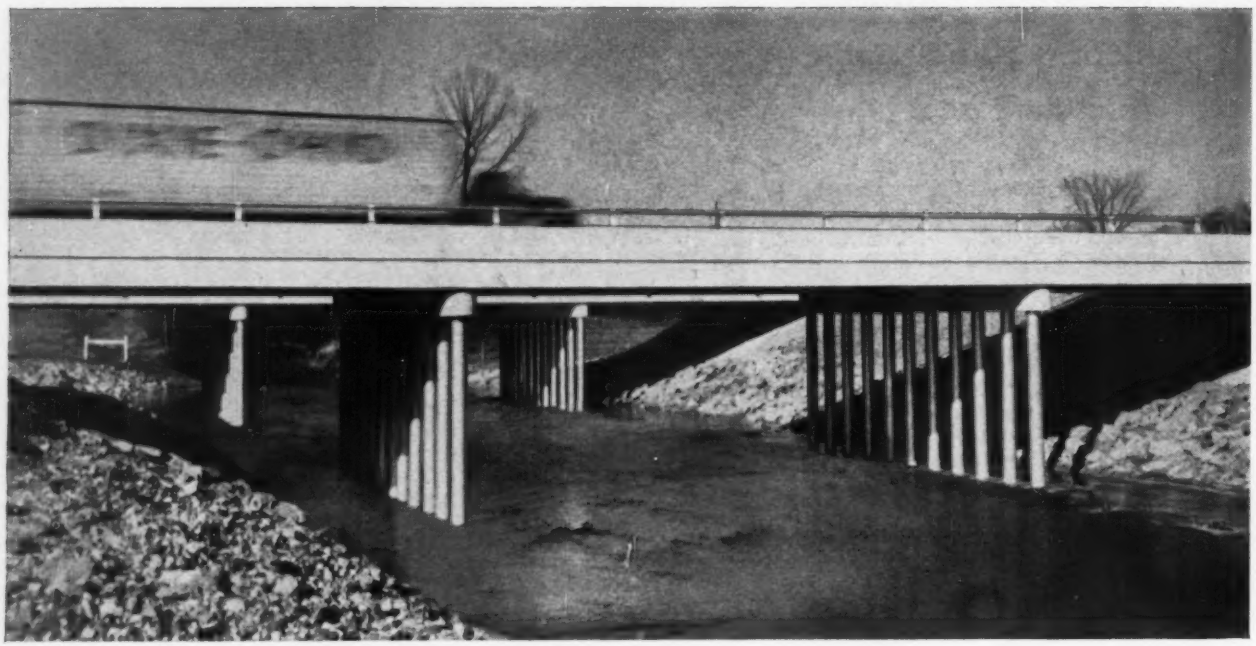
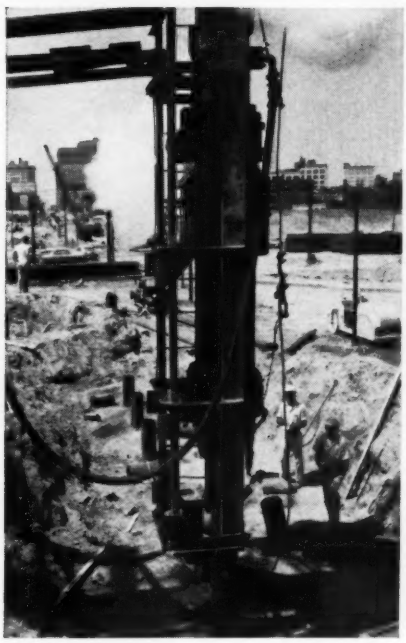


3.

4.

1. Twin bridges on exposed Armco Pile bents carry Interstate 71 over Clear Fork Creek in Ohio.
2. Armco Piling is driven for foundation of bridge abutment on Cleveland Innerbelt — part of Interstate 90 in Ohio.
3. Here are 60-foot lengths of Armco Piling at site of foundation for approach work of new Woodrow Wilson Bridge at Alexandria, Virginia. Interstate 495.
4. Interstate 10 construction at Lake Charles, Louisiana, features foundation of Armco HEL-COR® Pile Shells.
5. Bridge abutment on Interstate 5W in California will rest on Armco Pipe Piling foundation. Note batter piles.

and Pile Shell Get the Important Jobs **on the Interstate System**



2.

Interstate Highway construction, with its controlled access requirements, puts the spotlight on bridges. To handle the tremendous job of foundations for the hundreds of bridge piers and abutments, highway builders are relying more and more on the Armco family of foundation products. Why? *They have been proved in service.* Engineers and contractors know what they will do from past performance.

Armco Pile Shell is a lightweight, helically corrugated shell. It is supplied in specified lengths—*any* lengths up to 64 feet. It is well known for its uniform roundness that makes splicing easy. Salvage of short cut-offs is practical.

Armco Steel Pipe Piling is available in specified lengths up to 90 feet. By specifying lengths, you reduce field splicing to a minimum. Handling is simplified, driving goes fast. Armco Piling is made to ASTM Specification A 252-59, and it is delivered with a mill certificate to prove it. This mill certificate assures the exclusion of sub-standard pipe from your projects.

You can get Armco Pile Shell in 16 different diameter-wall thickness combinations; Pipe Piling in 132 diameter-wall thickness combinations. Thus you can specify *exactly* the foundation pipe you need, without compromise.

Use the coupon to send for a 16-page catalog on Armco Foundation Products. It provides the specifications and dimensional data you need. In addition, an authoritative, 105-page book, "Pipe Piling for Bridges and Buildings" is available through the Armco Sales Engineer in your area. Check the coupon to reserve your free copy. **Armco Drainage & Metal Products, Inc., Subsidiary of Armco Steel Corporation 5871 Curtis Street, Middletown, Ohio.**

5.

New steels are born at Armco

Armco Drainage & Metal Products, Inc.,
5871 Curtis Street, Middletown, Ohio

☐ Send me the 16-page catalog on Armco Foundation Products.

☐ Ask Armco Sales Engineer to bring me comprehensive, 105-page book, "Pipe Piling for Bridges and Buildings."

NAME ..... TITLE .....

FIRM .....

STREET .....

CITY ..... ZONE ..... STATE .....

TELEPHONE NUMBER .....

ARMCO Drainage & Metal Products

THE UNITED ENGINEERING CENTER
AN

FOUNDATION
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- *Empire State Building*
- *New York Coliseum*
- *Massachusetts, Connecticut, Maine, Pennsylvania, New Jersey Turnpikes*
- *Long Sault Dam*
- *Iroquois Dam*
- *N.Y. Board of Water Supply Reservoirs*
- *Delaware Memorial Bridge*
- *Tappan Zee Bridge*
- *Walt Whitman Bridge*
- *Mackinac Straits Bridge*
- *Holland Tunnel*
- *Brooklyn Battery Tunnel*
- *Penna. Turnpike Tunnels*
- *Philadelphia Internat'l Airport*
- *New York Internat'l Airport*

SPRAGUE & HENWOOD, Inc.

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New York • Philadelphia • Pittsburgh • Nashville • Salt Lake City • Tucson • Buchans, Nfld.

Shopper stopper of steel. Long before the Preston Royal Village Shopping Center in Dallas, Texas, was completed, this unusual *curved* steel roof was attracting hundreds of potential customers. This supermarket roof, using structural steel in striking Lamella construction, is just one part of the $2,000,000 center. The vast supermarket building alone encloses almost 20,000 square feet of shopping space containing one of the most complete displays of food in the Southwest. And there isn't a column or post in the entire sales area. The Lamella construction was by Roof Structures, Austin, Texas.

USS United States Steel

TRADEMARK

See next two pages

"Steel fastest, most economical." Speed of construction, low cost and reduced fire insurance rates were the main reasons why Structural Steel was used to build the 25-acre Preston Royal Shopping Center in Dallas, Texas. "Structural Steel in this type of construction is year-in and year-out the fastest and most economical method of framing in this area," the contractor said. "The quicker erection time with steel was figured in on this project from the very start." Readily available and speedily fabri-

Interesting details — Preston Royal Village. The $2,000,000 shopping center is one of the largest in the Southwest—110,000 feet of floor space. This first use of steel Lamella construction in this area eliminated columns and permitted a gracefully curving roof for the main building. 26 businesses, including a theater, restaurant and service station, are housed in the shopping center . . . and fast erection with structural steel permitted early opening for all of them.

This mark tells you a product is made of modern, dependable Steel.

cated, 300 tons of USS Structural Steel did the job. Structural Steel can cut construction time 25% in structures like this. Fast deliveries and quick fabrication of USS Structural Steel can be obtained in any part of the country. USS is a registered trademark.

United States Steel Corporation • Columbia-Geneva Steel Division • Tennessee Coal and Iron Division • United States Steel Supply Division • United States Steel Export Company.

USS United States Steel

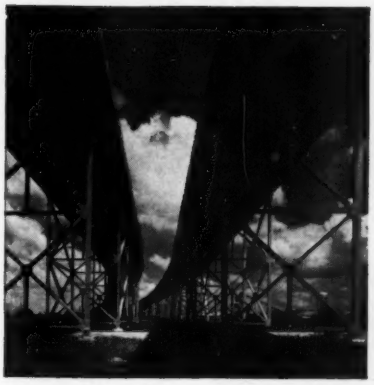
Owner: Tramell Crow and Associates.
Architect: Harold A. Berry, with Donald H. Speck as associate.
Contractors: McFadden & Miller.
Managing and Leasing Agent: Henry S. Miller Company.
Steel Fabricator: Mosher Steel Company.

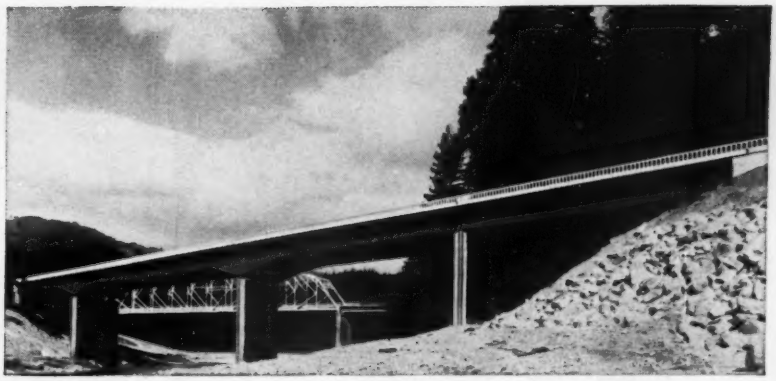
Cortland State Teachers College Science Building, Cortland, New York.
Sargent Webster Crenshaw & Folley, Architects and Engineers; Carl Larson, State Architect; Otto Teegen, State University Architect.

FRAMING COSTS CUT 20¢/SQ. FT. WITH COMPOSITE STEEL DESIGN

Engineers on this project specified the Nelson Composite Beam and picked up a substantial 20¢-per-square-foot saving over the more conventional construction techniques (beam and slab, steel frame and fireproofed bar joist or steel frame and block). The reduction of the girders to 12 WF provided a saving in construction height which, in turn, gave the engineers opportunity to reduce story height. The Nelson Composite Beam offers engineers a choice of meeting equal load requirements with as much as a 30% reduction in structural steel weight—or an increase in strength with the same size beams. It provides longer spans with greater load-carrying capacity per pound of steel; more unobstructed floor space, through wider spacing of columns. For more information about composite-designed buildings and the Nelson Composite Beam, write to **NELSON STUD WELDING,** Div. of Gregory Industries, Inc., Dept. 10, Lorain, Ohio.

GREGORY INDUSTRIES





LET'S LOOK AT THE FACTS...

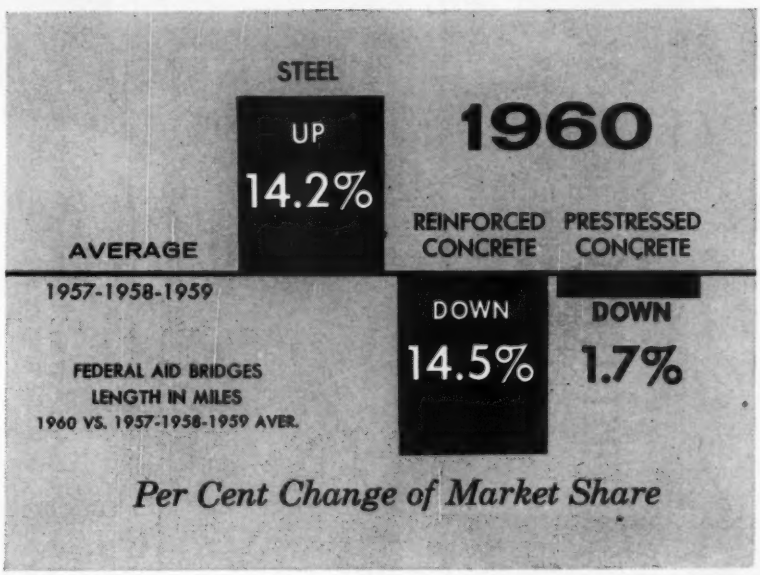
STEEL IS THE DOMINANT AND GROWING STRUCTURAL MATERIAL FOR BRIDGES!

Only *steel* increased its market share of federal aid highway bridges in 1960, compared to the three-year average of 1957-58-59, in terms of *total length of bridges authorized*.

Steel's percentage *increased* from 45.2 per cent of the total bridge length in 1957-58-59 to 51.6 per cent in 1960.

Reinforced concrete's percentage of total bridge length *decreased* from 42.9 per cent in 1957-58-59 to 36.7 per cent in 1960.

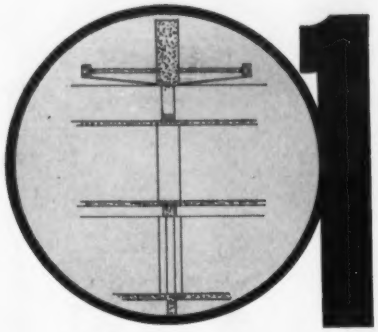
Prestressed concrete's percentage of total bridge length *decreased* from 11.9 per cent in 1957-58-59 to 11.7 per cent in 1960.



Good reasons for steel's increased use...

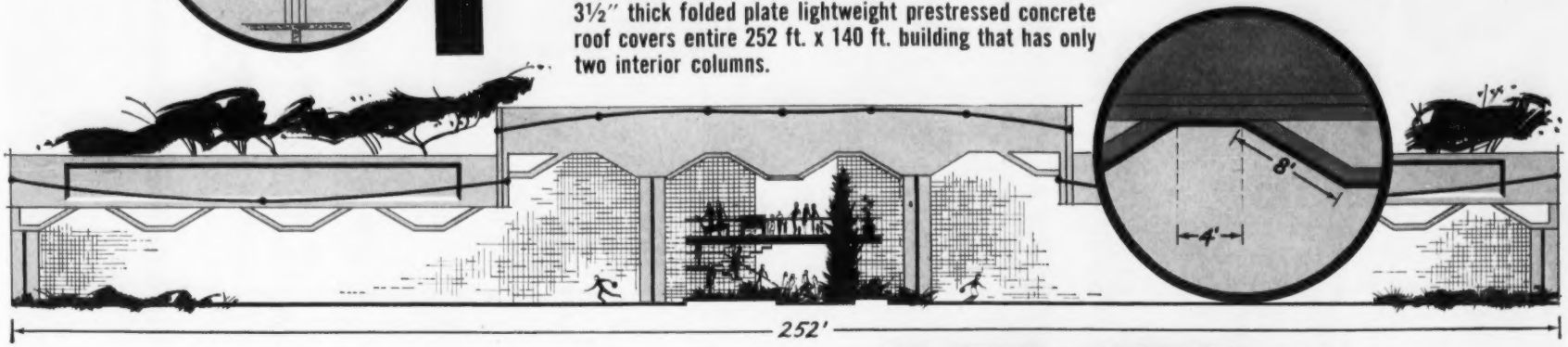
Steel is strong. Reliable. Versatile. Adaptable. And economical. Design your next bridge with steel; build it with steel. You'll find that steel makes sense. American Institute of Steel Construction, N. Y. 17.

Steel **STANDS** *for the future* AISC



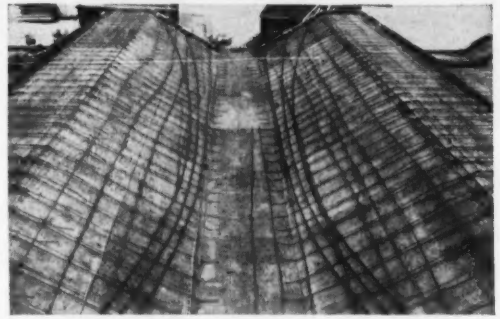
POST-TENSIONED PRESTRESSED CONCRETE BEAM HOLDS ROOF OF 42,500 SQ. FT. BOWLING ALLEY!

3½″ thick folded plate lightweight prestressed concrete roof covers entire 252 ft. x 140 ft. building that has only two interior columns.



Three cast-in-place post-tensioned, prestressed concrete beams tied together with Prescon stressing tendons into one long unit make possible the unique structure of a 48 lane bowling alley that has no support columns in the lane area.

The Buccaneer Bowl in Corpus Christi, Texas was constructed at a cost of only $8.40 per square foot using a concrete roof and support beam prestressed by the Prescon System of post-tensioning. This price includes a partial basement, a mezzanine restaurant, observation deck and a luxurious lobby — all air conditioned. The cost of the folded plate and the supporting beams was $1.36 per square foot of area.



Forms built of 4′ x 8′ plywood sheets ready for pouring of folded plate roof. Stressing tendons provide strength for 70′ span.

PRESCON®

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THE PRESCON CORPORATION

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MEMBER PRESTRESSED CONCRETE INSTITUTE

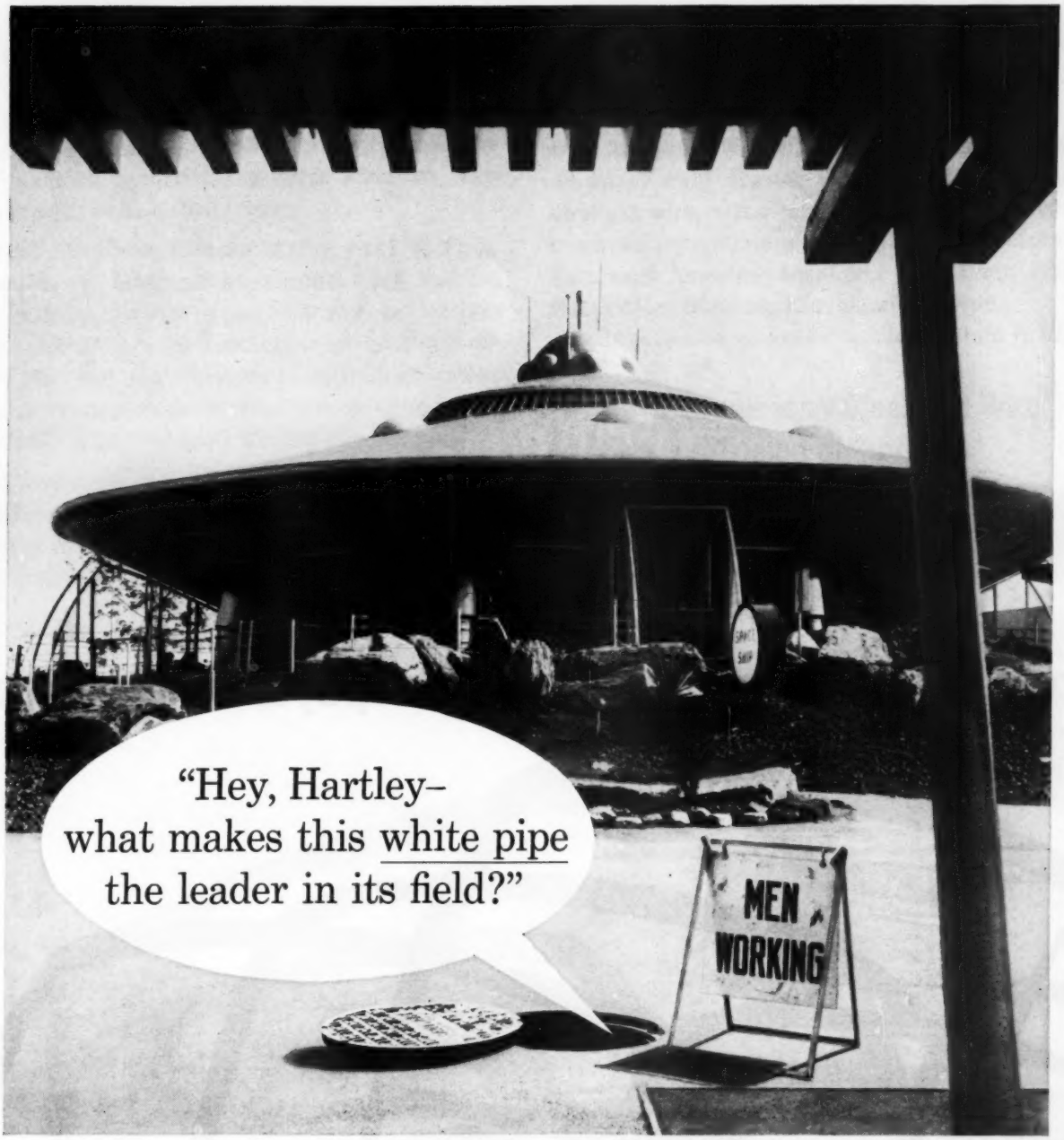
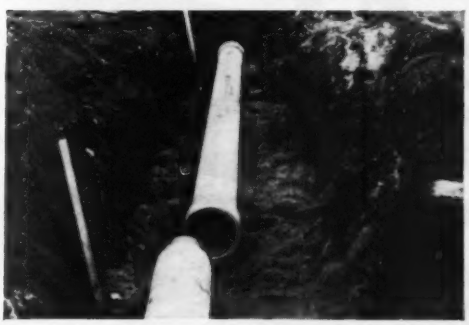


Photo of Space Ship taken at Freedomland, New York, N. Y.

Simple! Always being first with the best. You see, Transite®, *the white sewer pipe*, was the first asbestos-cement pipe ever used for sewer service in the U.S. And, over the past 30 years, Johns-Manville has continued to lead the way in sewer pipe improvements.

Johns-Manville was the first to come out with long (10 & 13-ft.) lengths . . . to develop precision-machined joints, instead of molded ones . . . to make five strength classes for greater economy and flexibility in system design . . . to stencil each pipe with class and strength . . . to provide *double* flexibility at each joint . . . to use high-pressure steam curing for maximum chemical stability. Add to all this the availability of pressure-sewer lines and J-M's invaluable field instructor service, and it's easy to see why Transite is the leader in its field.

Despite the fact that others have tried to improve their products, Transite's advantages are still second to none. To get the whole story, write Johns-Manville, Box 362, CE-7, New York 16, N. Y. In Canada: Port Credit, Ontario. Cable address: Johnmanvil.



JOHNS-MANVILLE
TRANSITE PIPE

Be kind to taxpayers. Reinforce

Civic pride. Driving comfort. Taxpayer satisfaction. All are reasons for making sure that your urban redevelopment plans start with smooth, long-lasting streets. Take a tip from the concrete toll roads in service today: over 95% are reinforced with welded wire fabric.

It's good business to build streets that last. First, if Federal or State aid pays initial cost, maintenance costs are up to you. Second, tax dollars don't stretch very far if maintenance costs are excessive. Third, maintenance costs are high unless you reinforce your pavement the most economical way: with USS American Welded Wire Fabric.

USS American Welded Wire Fabric delivers the tensile strength needed to control cracks due to variations in temperature, moisture, soil shifting and traffic loads. It distributes balanced design that protects edges and corners. By actual measurement, welded wire fabric's ability to control cracks adds 30% to the strength of the slab.

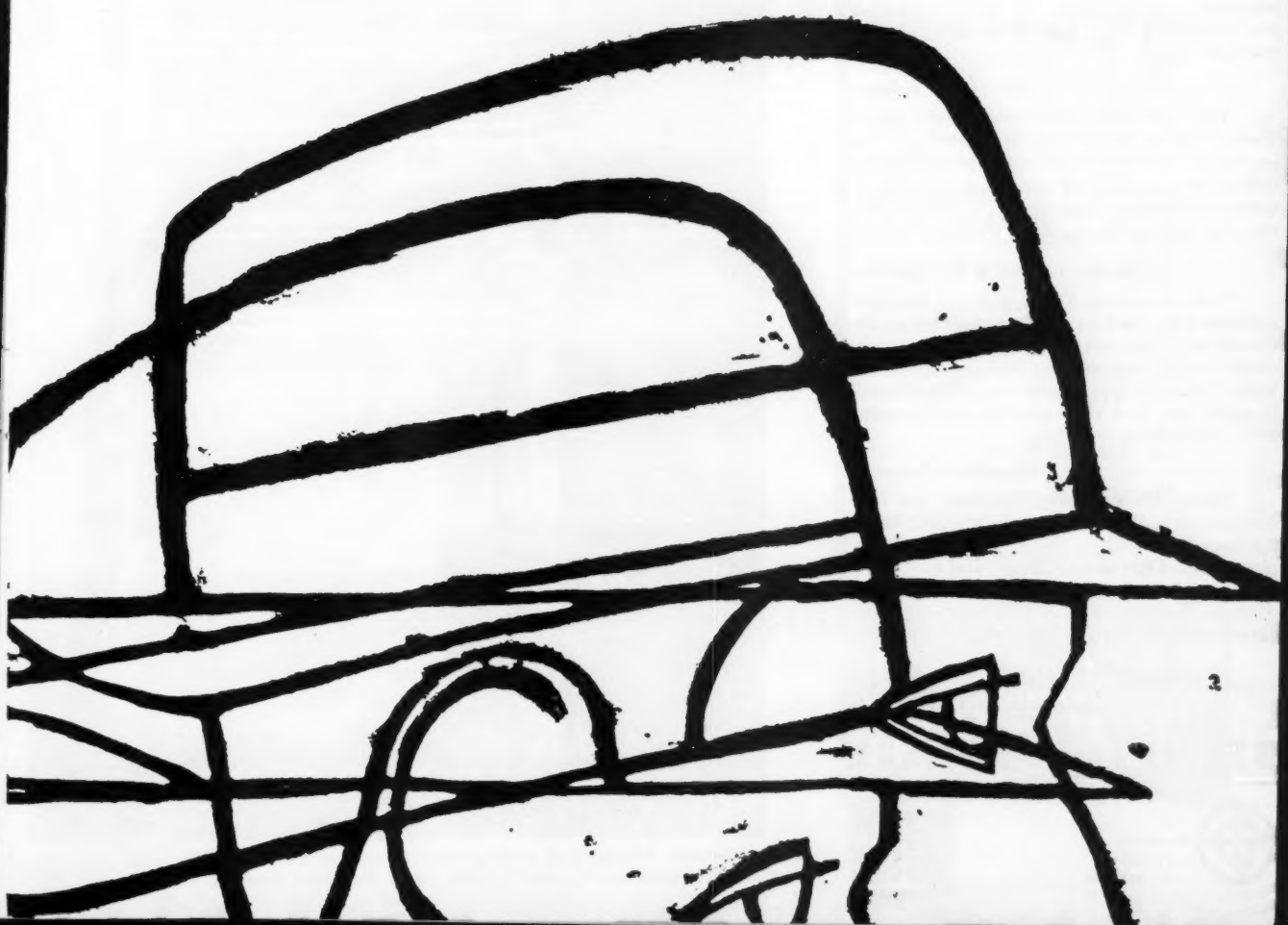
USS American Welded Wire Fabric is precision-made of cold-drawn, 60,000 psi min. yield strength wire, sized to your exact requirements, ready for immediate placement. For full information, write American Steel and Wire, Dept. 1289, Rockefeller Building, Cleveland 13, Ohio.

USS and American are registered trademarks **Innovators in Wire**

American Steel and Wire Division of United States Steel

Columbia-Geneva Steel Division, San Francisco
Tennessee Coal and Iron Division, Fairfield, Ala.
United States Steel Export Company

America's new city streets with welded wire fabric.



Architects: Walter Hook Associates; *Structural Engineers:* R. V. Wasdell and J. R. Armstrong; *General Contractors:* Southeastern Construction Co., Goode Construction Corp., F. N. Thompson, Inc., and McDevitt & Street Co. Structural steel was fabricated by Southern Engineering Co., Charlotte, N.C., and Bristol Steel and Iron Works, Bristol, Va. Bristol erected all steel.

all columns outside clear space inside

When completed, the North Carolina National Bank Building in Charlotte will be the largest and tallest all-welded, steel-framed building in the Southeast.

The building will have 16 floors plus a 2-story penthouse. The tower will be in two sections: a main tower for bank personnel and leased offices; a service tower for elevators and stairs.

No interior columns

You can see clear through the Main Tower! 36-in. wide-flange sections span the entire 55-ft width. Not a single column to get in the way of floor arrangements. Partitions can be placed anywhere . . . office space can be arranged as the tenants desire.

Largest columns in the Carolinas

You can also see the largest and heaviest columns ever used in an office building in the Carolinas. The column sections, rolled specially by Bethlehem, are 36¾-in. deep and weigh 369.3 lb per lineal foot. That's 69.3 lb more per foot than the heaviest regular 36-in. wide-flange section.

All-welded steelwork

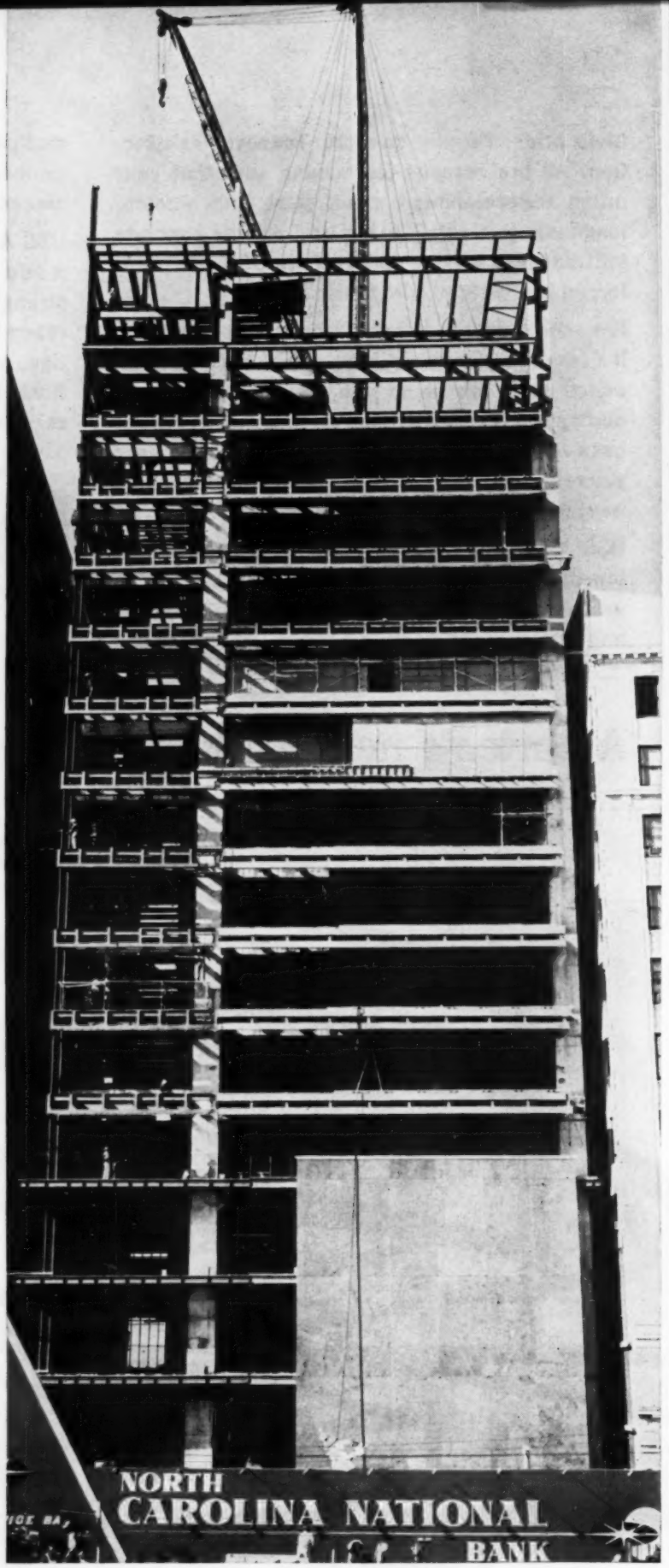
Using these heavy sections as the column core, the columns are welded, built-up members with a 20-in. x 2¾-in. cover plate welded flat on one flange, and two 30-in. x 2¾-in. plates welded perpendicularly to the edges of the other flange. The finished, fabricated columns weigh 1,100 lb per lineal foot.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

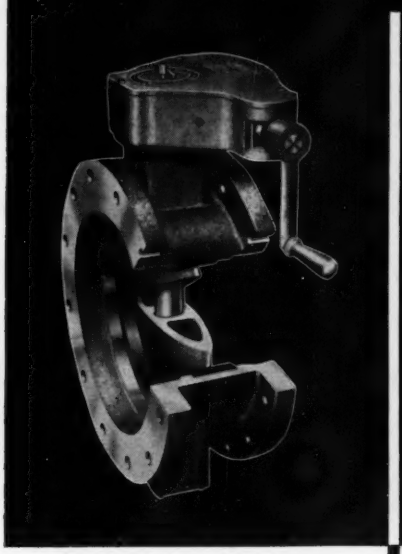
Steel
For strength
. . . economy
. . . versatility

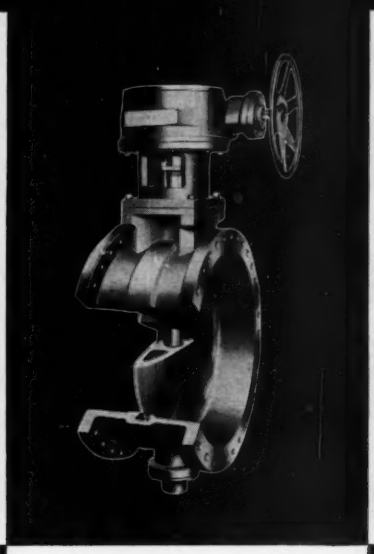
BETHLEHEM STEEL

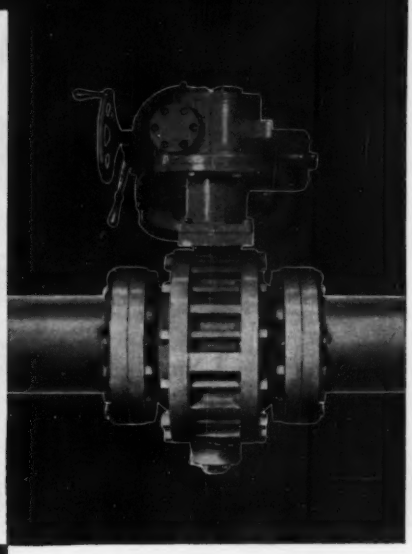


ALL-WELDED. *150,000 lb of welding rods were used in shop fabricating, and 35,000 lb were used in erecting 3,800 tons of Bethlehem structural steel.*

Now! PRATT STANDARD RUBBER SEAT VALVES FROM VACUUM TO 250 psi







150 psi Standard Valve Flanged or Monoflange

This Henry Pratt valve is loaded with extra values . . . the most *rugged construction* available . . . lower costs due to complete standardization . . . and economical *space savings* thru new narrow face-to-face dimensions in classes up to 125 psi . . . *new sidewinder operator* with manual, cylinder and motor types.

Highly versatile—available in 2 flange or monoflange types, with floor stand or extension bonnets, and completely sealed operators for buried service.

For AWWA classes 25-8 thru *125-16* in sizes 4″ thru 20″.

Write for Bulletin 6AV

50 and 125 psi Standard Valves with adjustable seat

For the first time, 50 psi Standard Valves are available with economical narrow face-to-face dimensions thru the full 50-16 classification. The 125 psi Standard Valves in wide face-to-face offer traditional Pratt ruggedness in classes 50-8 thru 125-16. In all classes the valve seats are factory adjusted around their perimeter for the most precise fitting of disc to seat, a feature that offers:

Easier operation—with a precisely fitted seat.

Longer Life—accurate control of disc-seat interference provides tightness without wear.

Bubble-tight operation up to 150 psi.

Easy field adjustment . . . seats can be adjusted or even replaced without dismantling the valve or removing it from the line . . . and the seat fitting will be factory accurate.

Sizes 24″ thru 72″.

Described in Bulletin 6AV

Pratt Rubber Seat Ball Valve for 150 and 250 psi

Resilient seating has now been applied to ball valves—putting the time-proved advantages of this seat to work at higher pressures and velocities than ever attained before.

The Henry Pratt Ball Valve offers bubble tight performance for ball or cone valve applications plus these definite advantages: *less weight, smaller size, lower operating torques* than similar valves . . . and *no more pressure drop than equivalent length of pipe*. The rubber seat will not bind or stick and compensates for line distortion. One man operation against full line pressure.

Complete line of operators and accessories. Ideal for buried service with enclosed operator. Sizes 10″ thru 48″.

Write for Bulletin BA-1AV

Creative Engineering for Fluid Systems

HENRY PRATT COMPANY
319 West Van Buren Street • Chicago 7, Illinois
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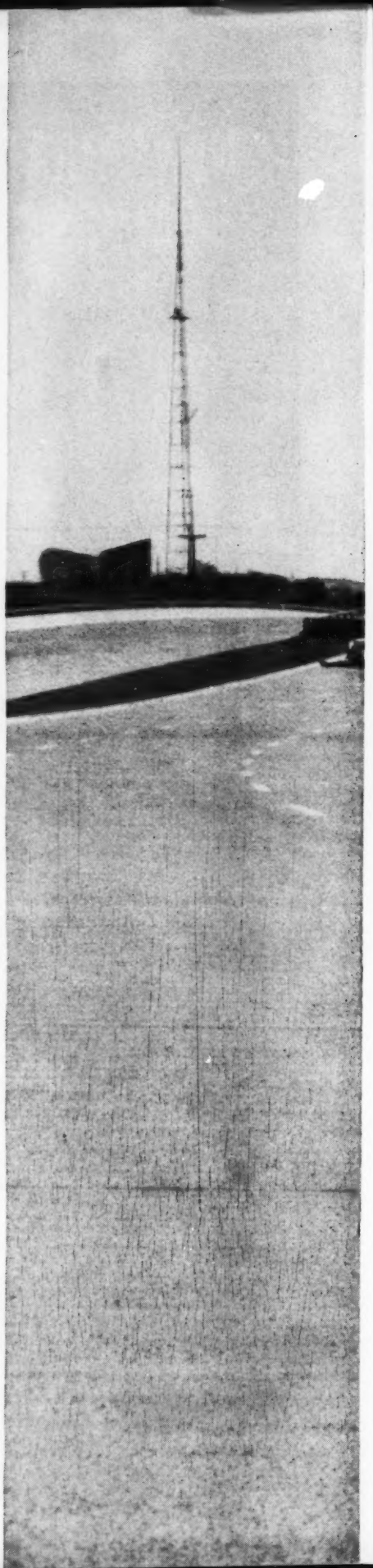


Texas' 352 miles of Interstate awarded to concrete promise big savings in upkeep!

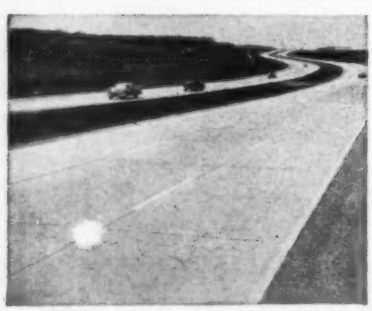
Across Texas, these modern concrete highways are steadily growing in length. They will long be a public reminder of the skills and dedication of the engineers and builders who are creating them.

A solid future is built right into roads like these. Only concrete has load-bearing strength that can be matched *mathematically* to future traffic needs. Only concrete enables engineers to design pavements to last 50 years and more.

Concrete isn't flexible, so there are no "moving parts" in it to cause hidden wear. And even with the highest temperatures, it won't soften and ripple under traffic. Concrete can't oxidize. There's never adverse chemical reaction to sun, cold, air or moisture. Concrete actually grows stronger year by year.

All these advantages mean extra thrift for Texas as it builds with concrete: Exceptional pavement life . . . upkeep costs that run far less than for asphalt. It's for reasons like these that most Interstate mileage across the nation today is going to concrete.

At right: Texas Interstate 35E, Stemmons Freeway out of Dallas. Below: Texas Interstate 20, Dallas—Ft. Worth Turnpike.

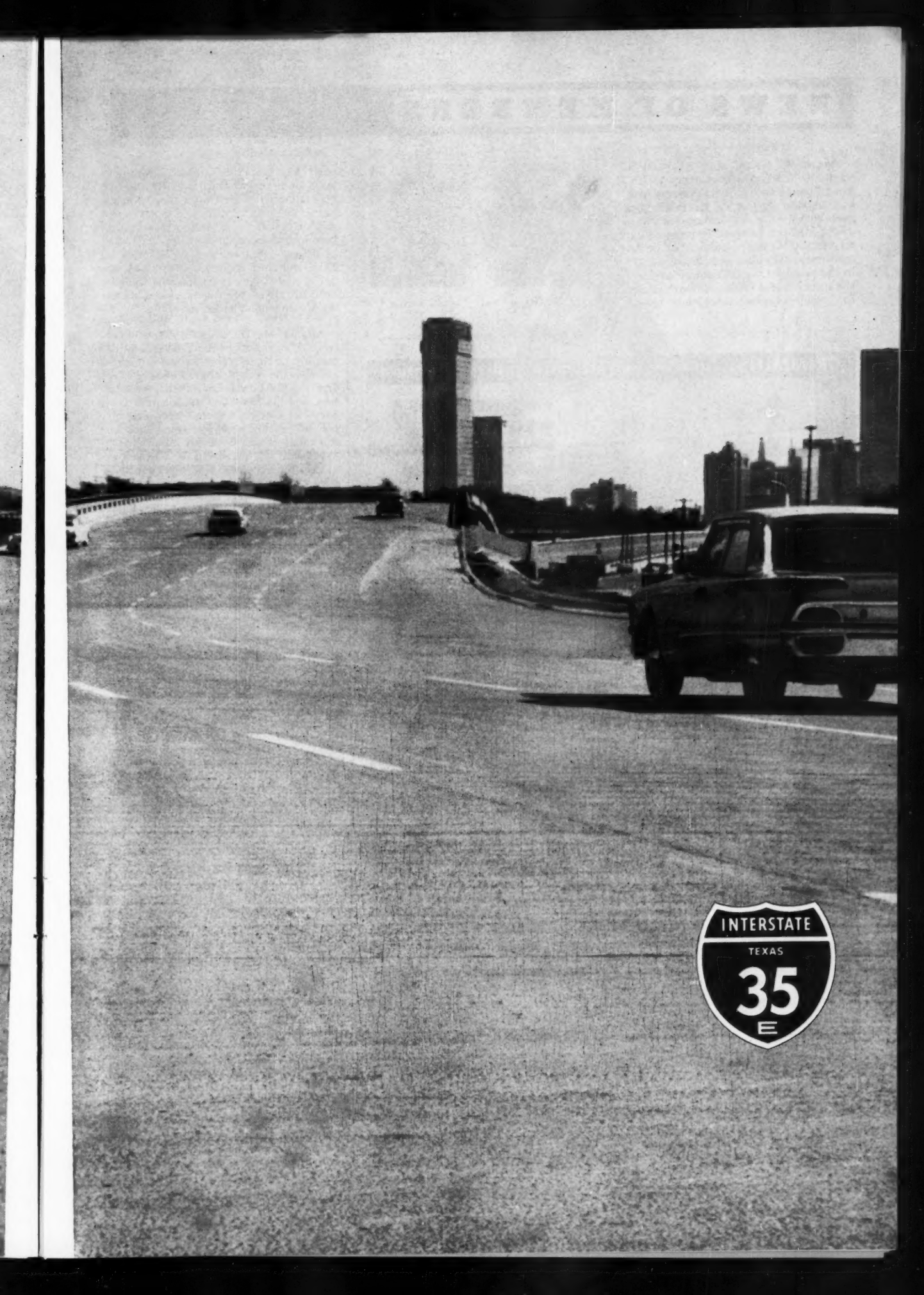


38% maintenance saving with concrete, Texas' 31-year records show!

Official Texas State Highway Department records give the facts: Since 1929, road maintenance costs per mile per year for concrete have averaged $144.68; for asphalt, $235.23. Texas' new concrete highways will do even better!

PORTLAND CEMENT ASSOCIATION

A national organization to improve and extend the uses of concrete


INTERSTATE
TEXAS
35
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NEWS OF MEMBERS

Joseph W. Gross, after 32 years of service with the Wayne County (Mich.) Road Commission, retired as County highway engineer August 19. His first assignment with the County Commission was as a field engineer, followed by promotion to secretary of the Board and head of the Administrative Division and, then, in 1957, to the post of County highway engineer. His successor, **Sol Lifsitz,** although eligible for retirement, plans to continue for another five years his affiliation with the Road Commission which goes back to his graduation from the University of Michigan in 1926. Mr. Lifsitz joined the Commission's staff as a structural designer, becoming chief designer in 1951, engineer of design, structures and expressways in 1957, and chief engineer in 1958. As the new County highway engineer he will coordinate all engineering activities under the Commission's jurisdiction.

J. W. Gross

Sol Lifsitz

Adolph Meyer, hydrology consultant from Minneapolis, Minn., was honored recently by three Nebraska water organizations—the Loup River Public Power District, the Lower Loup-Platte Association, and the Mid-State Reclamation District—as a man "who has dedicated his life to excellent engineering, creative thinking and service to his fellow man." Specifically, he has served for 16 years as a consulting engineer with the Loup District; played an active part in the proposed Lower Loup Storage Project; and in 1943 conceived of the Mid-State project.

Carl R. Miller, formerly assistant chief of the Watershed Technology Research Branch at the Agricultural Research Service's Soil and Water Conservation Research Division, has assumed new duties as director of the U.S. Sedimentation Laboratory at University, Miss. Extensive research is now underway there on the entrainment, transportation, and deposition of sediments and stability of natural and artificial channels as it pertains to agricultural watershed developments.

John H. Brittain, a Captain in the U.S. Coast and Geodetic Survey, retired recently after 36 years of service. He was chief of the Geodesy Division from 1957 to 1960 and for the past year assistant director in the Office of Physical Sciences in Washington, D. C. Mr. Brittain will make his home in St. Petersburg, Fla.

Stanley T. Barker is now sanitary engineer in the Bangkok, Thailand office of the Officer in Charge of Construction (OICC), for Southeast Asia, U.S. Navy Bureau of Yards and Docks. In the past he has served with the New York State Department of Health as assistant director of the Bureau of Environmental Sanitation; with Architect-Engineers Spanish Bases as sanitary engineer; and as sanitary civil engineer on BuDocks Contracts in Spain.

Peter J. Cassimatis, since receiving a Masters degree in Business Administration last June, has joined the Bechtel Corporation in New York as a civil engineer. He previously served in a similar capacity with the New York firm of C. J. Foster.

Edmund H. Lang, a Colonel in the Corps of Engineers, after three years as director of the Army Engineer Waterways Experiment Station at Vicksburg, Miss., has a new assignment as deputy Eighth Army engineer in Korea.

CRIMMINS...quality performance in diversification

- FOUNDATIONS
- ROCK WORK
- WET EXCAVATIONS
- UNDERPINNING
- SHORING
- CAISSONS
- HEAVY CONSTRUCTION

CRIMMINS...OVER A CENTURY OF PROGRESS

CRIMMINS...GRATIFYING PROOF OF QUALITY

THOMAS CRIMMINS CONTRACTING COMPANY
624 Madison Avenue, New York 22, N.Y., EL 5-0270

John William Gaddy, for several years a professional engineer in Anchorage, Alaska, is now located in Cimarron, Kans., where he is executive vice president and a director of LeFavour, Inc., whose specialty is estates. His past professional associations were as general superintendent of the Chas. H. Tompkins Company in Washington, D.C.; as manager of the Contracting Department and general superintendent of the Culpeper Building & Supply Corporation in Virginia; and as supervisor of construction for Stevens & Wilkinson at Atlanta, Ga. When he left Anchorage, Mr. Gaddy was president of the Anchorage Branch of the Alaska Section.

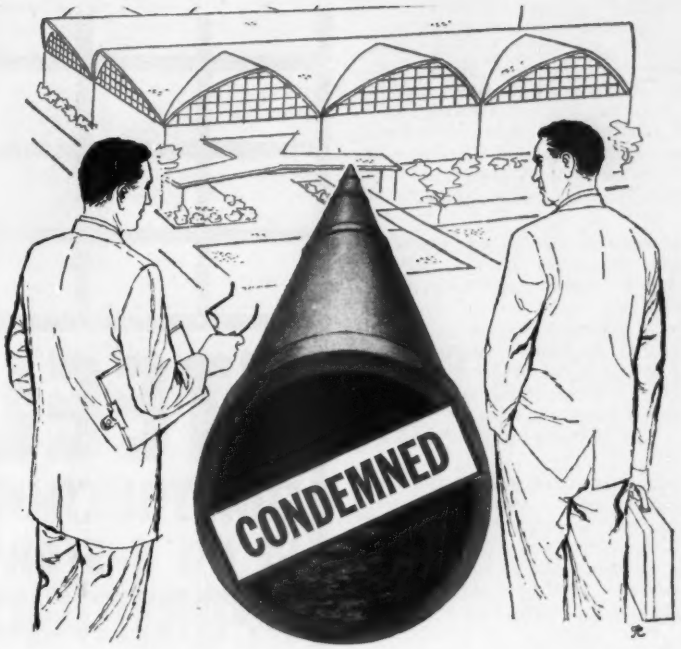
William Ditmer Jordan has been named head of the department of engineering mechanics at his alma mater, the University of Alabama. Until this appointment Dr. Jordan was a professor in the department.

Rajagopalan Rangachari, since returning to his native India after a six month stay in the United States, during which time he specialized in optimum resources development with particular reference to river valley projects under the International Cooperation Administration program, has resumed his duties as deputy director in the Ministry of Irrigation and Power of the Government of India. His current assignment includes acting as a consultant to his Government on the basinwise development plant for the Ganges River.

James P. Hawke, internationally known consulting structural engineer, has opened a consulting engineering office at 503 Market Street, San Francisco, Calif. His planning and design assignments in the international field have included the $100 million Karnafuli Dam in East Pakistan and the $188 million Volta River Hydroelectric Project in Ghana (Africa). He also directed the engineering design of the Lockheed Navy Polaris Missile Plant at Sunnyvale and the Tri-Dam Project of the Oakdale-South San Joaquin Irrigation District, both in California.

William H. Sturman, Lieutenant Commander in the Navy's Civil Engineer Corps, took command on August 26 of the Naval Mobile Construction Battalion Nine at Midway Island, relieving **F. W. Arnold,** Commander in the Civil Engineer Corps, who reported to Manila, Philippine Islands. Lieutenant Commander Sturman previously served at the San Francisco Navy Shipyard and worked on the development of Nuclear Submarine power plants under the Atomic Energy Commission.

(Continued on page 35)



LET US SOLVE YOUR INDUSTRIAL WASTE PROBLEM

Today's modern industries and processes often create industrial waste problems that can actually stall profit-making applications of new discoveries.

Naturally enough, communities feel that public health comes first, and some industrial wastes and acids may eat up sewer lines fast.

At Crystal Lake, Illinois, the Clay Pipe industry has built a modern new testing laboratory. Experimentation is constantly going on to test pipe and jointing materials to see which is actually the best under all conditions for sanitary and industrial wastes.

Tests show that Vitrified Clay Pipe with its new resilient self-sealing joints is impervious to the corrosive action of sanitary sewerage and industrial wastes and acids which normally flow through sewer lines.

But yours may be a special problem. Let us help you with it. Write, outlining the problem to be tested, to:

NATIONAL CLAY PIPE MANUFACTURERS, INC.
1028 Connecticut Ave., Washington, D. C.

Please send me full details on the new factory-made compression joints on Clay Pipe.

(name)

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THE STANDARD in SANITARY SEWERS

NATIONAL CLAY PIPE MANUFACTURERS, INC.
1028 Connecticut Avenue Washington 6, D. C.

STEEL CONSTRUCTION IN AN 8-STORY APARTMENT BUILDING? YES AND IT SAVED $80,000

For the builders of new Hinman House in Evanston, Illinois, steel offered exceptional flexibility of design and a direct saving of $80,000 in construction costs. The 8-story building has 80 deluxe apartments. Typical floors are 68′ x 165′ and cubic footage totals 1,020,000.

"We saved in many ways," says Mr. Roy Schoenbrod, the architect. "Designed and bid both for steel and for concrete, the steel bid proved to be decidedly less expensive. What's more, during construction we observed that steel construction made the job easier for the pipe trades such as heating, air-conditioning, conduits and plumbing. Work went faster and labor costs were reduced considerably. This was our first experience with steel on a building of this size, but now that we've seen what it can do, we'll think of steel first from now on."

Use Steel for Modern Construction

STEEL CONSTRUCTION OFFERS design flexibility

. . . freeing the architect and engineer from patterns of the past . . . allowing unlimited play to creative imagination. In the practical solution of space design, large column-free areas are easily achieved. Cellular floors can be tack-welded to beams and girders providing built-in space-saving raceways for present and future power, phone and signal lines.

high strength with low weight

. . . reducing foundation costs due to excessive dead load . . . reducing floor heights which in turn save considerably on exterior wall surfaces while reducing the overall cubage required for the air-conditioning load.

and economy

. . . savings readily apparent when steel bids are compared with material other than steel. What's more such savings accrue regardless of size of building—from horizontally structured apartment houses or hospitals to vertically-reaching hotels or office buildings. Earlier occupancy, interest savings on construction loans, lower labor costs, all contribute to make steel by far your best actual and potential value for every construction dollar.

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Louis G. Puls retires on October 1 as chief designing engineer of the Bureau of Reclamation at Denver, Colo., after more than 30 years in Government service. Prior to his present position, Mr. Puls was assistant chief designing engineer from 1956 to 1958 and head of the Concrete Dams Section from 1952 to 1956. In January 1961, Mr Puls was granted the Distinguished Service Award, the Department of the Interior's highest honor.

Eudell G. Whitten is now with the Vinnell Corporation of Alhambra, Calif., as supervising general engineer in the Far East Division. He was last employed by the Trans-Ocean Corporation of Los Angeles as a senior engineer.

Arthur E. Stanley and **Frank W. Edwards,** partners in the Stanley Engineering Company, under the firm's recent incorporation became directors of the new company. In addition, **Allen H. Dunton** and **Murray W. Sedgley,** key employees with the Stanley Engineering Company since 1936 and 1948, respectively, are now listed among the firm's new owners.

Charles E. Remington has been named to the top engineering post in the Bureau of Land Management with his appointment as chief of the Division of Engineering. In this capacity he will be in charge of all Federal public land surveys. Mr. Remington has more than 26 years Federal career service experience, and was most recently regional engineer with the Forest Service of the U.S. Department of Agriculture in Denver, Colo.

A. T. Larned, recognized as one of the foremost authorities in the field of hydroelectric plant design, was named by Worcester Polytechnic Institute, his alma mater, recipient of the Robert H. Goddard Award for outstanding professional achievement. Mr. Larned retired last year as chief civil engineer of Ebasco Services, Inc., after a notable career in engineering and 48 years of continuous service with Ebasco.

Carl F. Newswanger was named assistant staff engineer in the Lancaster County (Pa.) Civil Defense organization. He is currently supervising engineer in charge of the city's sewers and two sewage treatment plants.

W. A. Hardenbergh, president and editor of *Public Works Magazine,* and a distinguished American sanitary engineer, is one of the eminent contributors to Volume V of the series, "History of the Medical Department, U.S. Army, in World War II." Mr. Hardenbergh drew upon his army experience acquired during the war when he served in the Surgeon General's Office as a Colonel in the Sanitary Corps.

Harold H. Weiland of Denver, Colo., is on home leave in the United States from his recent road project assignment in Haiti where he was chief of the public works division at the U.S. International Cooperation Administration mission in Port-au-Prince. Prior to his Haiti assignment, Mr. Weiland was for seven years chief of the public works division for the ICA mission in Lebanon. He worked with the Bureau of Reclamation in Fort Collins, Colo., before joining ICA in 1952.

John T. McCall, active in the fields of teaching, research, and industrial consulting, is now director of research and development at the Lock Joint Pipe Company of New Jersey. Until recently he was assistant director of research and development for the firm, having earlier served on the faculty of Michigan State University as associate professor in the Department of Applied Mechanics.

William Z. Lidicker recently became a vice president and director of American Engineers and Architects, Inc., with offices in Taipei, Taiwan and Manila, Philippines. His background includes experience as project engineer with the New York firm of Tippetts-Abbett-McCarthy-Stratton.

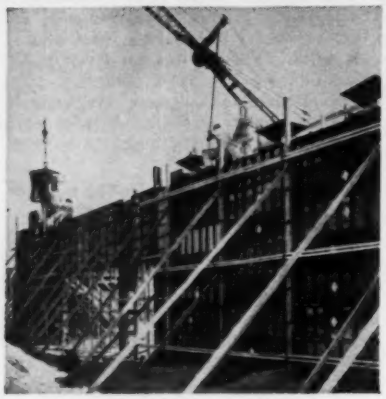
W. Wesley Eckenfelder, a process consultant at Radiation Applications, Inc., as well as professor of civil engineer at Manhattan College, N.Y., will assist the director of the group's new Resources Technology Division. Currently, Professor Eckenfelder's talents are being utilized by the Japanese Ministry of Industry and Trade toward the organization of a new waste and sewage treatment program in that country. While there he will lecture on waste treatment at the Universities of Tokyo, Kobe, and Kyoto. Only last month Professor Eckenfelder was in Europe to complete program arrangements for the first International Conference on Water Pollution Research scheduled for London, England, in 1962.

F. E. Willcox, Jr., is now with Charles L. Davidson and Associates in Beaumont, Texas, as an associate engineer. Prior to joining this firm, Mr. Willcox was with the Bethlehem Steel Company and the Texas Highway Department.

J. D. Little, Jr., has been selected to serve as director of the Industrial Development Division of the West Virginia Department of Commerce. His professional career includes experience as a consulting engineer in private practice; as a plant engineer with the Union Carbide and Carbon Chemicals Company; and as a geodetic engineer with the Inter American Geodetic Survey in Panama. Since 1957 he has been associated with the North Carolina Department of Conservation and Development's Division of Commerce and Industry, where he is presently chief engineer.

(*Continued on page 36*)

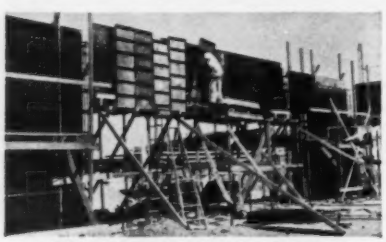
Decorative Walls



Horizontal gang forming with Symons steel-plys saves material and labor

Decorative outside walls, requiring V-scoring at 8-foot intervals, were poured with Symons Steel-Ply Forms by contractor MacIsaac & Menke, Los Angeles. The job—General Telephone of California's new offices in Norwalk.

Like many other contractors, MacIsaac & Menke consulted with The Symons engineering staff to determine if gang forming could be used. Symons recommended gang forming Symons Steel-Ply Forms *horizontally*, and using ½ inch standard V-joints at 8-foot spacings. Using this system the job could be



Workman setting Symons Steel-Ply Forms in place on section of building where gang forming was not required.

(and was) poured in much less time than other common methods.

Because all problems were worked out before starting the job, there was considerable savings in material and labor; and forming, pouring and stripping time was cut substantially.

For the *complete story, write us.* Symons Forms can be purchased outright or rented with purchase option.

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MORE **SAVINGS** FROM **SYMONS**

Robert W. Hewett, named a vice president of the United Improvement & Investing Corporation of New York, will also head in his capacity as president the new United subsidiary, the United Apartment Construction Corporation. Mr. Hewett has a wide background in the building industry, having formerly been a partner in the consulting engineering firm of Hewett and Heyman with offices in New York City and Plattsburgh, N.Y.

William J. Hedley, Vice President of ASCE, has been elected to a three-year term as president of Theta Xi fraternity, having previously served it as vice president. A specialist in railway-highway grade crossing safety, Mr. Hedley is now serving as chief engineer for the Wabash Railroad.

Richard N. White is now assistant professor of civil engineering at Cornell University. A recent recipient of a Ph.D. in civil engineering from the University of Wisconsin, Dr. White, in addition to his teaching assignments at Wisconsin, for the last few years has also engaged in consulting work in Madison, Wis., with John A. Strand.

E. P. Segner, Jr., who joined the civil engineering department at Texas Agricultural and Mechanical College in 1954, and is currently assistant professor there, has received a $10,000 research grant from the American Institute of Steel Construction, Inc. The project to develop a practical procedure for designing the necessary reinforcement around large rectangular openings in the webs of wide-flange steel members is expected to require from 12 18 months to complete and will be conducted by the Civil Engineering Department on the A & M campus in cooperation with the Engineering Experiment Station.

Raymond W. Sauer, until recently chief of the Engineering Division of the Corps of Engineers in Vicksburg, Miss., is now technical consultant to Major General T. A. Lane, president of the Mississippi River Commission and Division engineer. Starting his service with the Corps of Engineers in 1927, he was Vicksburg district engineer from 1942 to 1946, followed by many years as technical assistant.

Robert C. Miller, a Colonel in the Army Corps of Engineers, has succeeded **F. O. Diercks,** Colonel, as commanding officer of the Army Map Service in Washington, D.C. Especially notable has been Colonel Miller's recent duties as director of the Inter American Geodetic Survey; as chief of the Engineer Intelligence Division; as chief of the Project Vanguard Task Force in the Army Map Service; and as chief of the Intelligence Division for U.S. Army Forces in the Far East.

Robert L. Hull, with the Chicago Bridge and Iron Company since his graduation from the Michigan College of Mining and Technology in 1949, will be manager of a new Australian firm formed by CB&I in conjunction with Australian Consolidated Industries. The new group to be known as the Chicago Bridge-Lennox (Pty) Ltd., will have its headquarters in Alexandria, New South Wales. At the same time, **Dean E. Stephan** has been appointed managing director of Chicago Bridge Ltd., in London, the British subsidiary of CB&I. Mr. Stephan has been with the parent group since 1930, the last 16 years as manager of the Company's Los Angeles district sales office.

Austin B. Caseman, associate professor of civil engineering at the Georgia Institute of Technology, has received the degree, Doctor of Science in Civil Engineering, from the Massachusetts Institute of Technology. Mr. Caseman's thesis dealt with the application of energy methods to determine the elastic buckling load for thin, shallow, spherical domes.

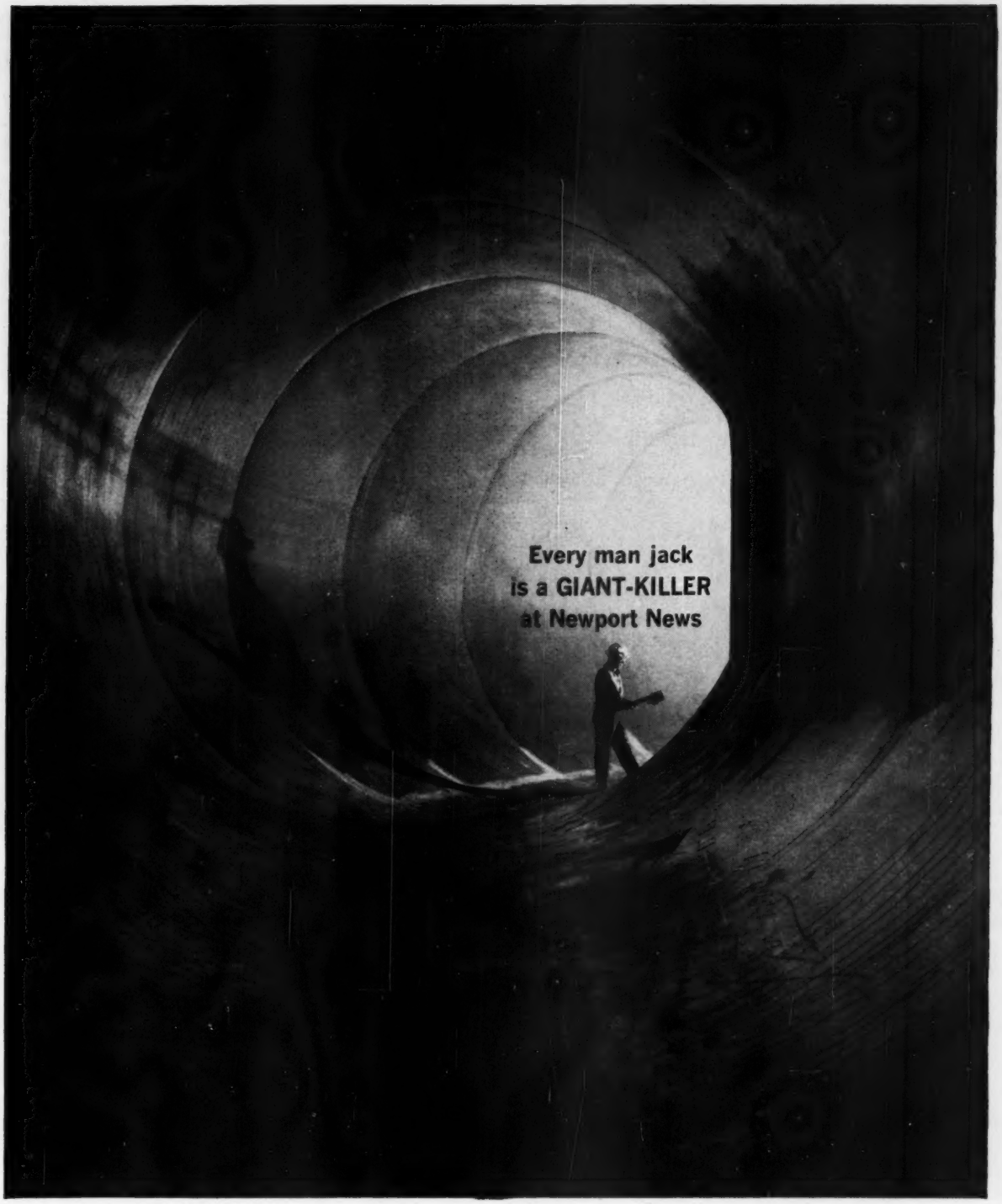
L. W. Newcomer, chief engineer for the Kansas Turnpike since it began operations in 1954, and office and contract engineer all during its planning and construction days, has been named engineer-manager of the Turnpike by the Kansas Turnpike Authority. Earlier, as county engineer he served Butler County, Kansas, for more than two decades.

David C. Liu, who as recently as a year ago was named an associate in Dames & Moore, of Los Angeles, has now been admitted to the firm's general partnership. Mr. Liu began his career with Dames & Moore in Seattle, serving in several different district offices until 1960 when he inaugurated and took charge of the Honolulu office.

Eugene E. Hoff, a civil engineer with the New Jersey State Highway Department, was recently appointed civil defense and disaster control director for the New Jersey Borough of Penns Grove. His last position was as senior civil engineer with the highway group.

Reginald C. Price will fill the post of vice president for California of the National Rivers and Harbors Congress during the present fiscal year ending May 31, 1962. After nearly 25 years of government service, including many years with the U.S. Department of Interior and the International Cooperation Administration engaged in conservation and water resources development, he is currently deputy director for policy of the California Department of Water Resources.

(*Continued on page 112*)



This huge hydraulic turbine casing dwarfs the workman—but to him and 15,000 others at Newport News, tremendous jobs such as this are routine.

Here giant engineering and production challenges are conquered in stride. Turbines, valves, gates and penstocks for the greatest hydroelectric projects—Niagara, Grand Coulee, Hoover and 96 others. Pressure vessels and similar heavy equipment for the petrochemical industry. Paper dryer rolls, wind tunnels, bridge caissons—almost any job that calls for heavy steel fabrication and machining of massive parts to close tolerances.

Whatever your project, call on Newport News. It has the men, methods and machines to accept the toughest challenge.

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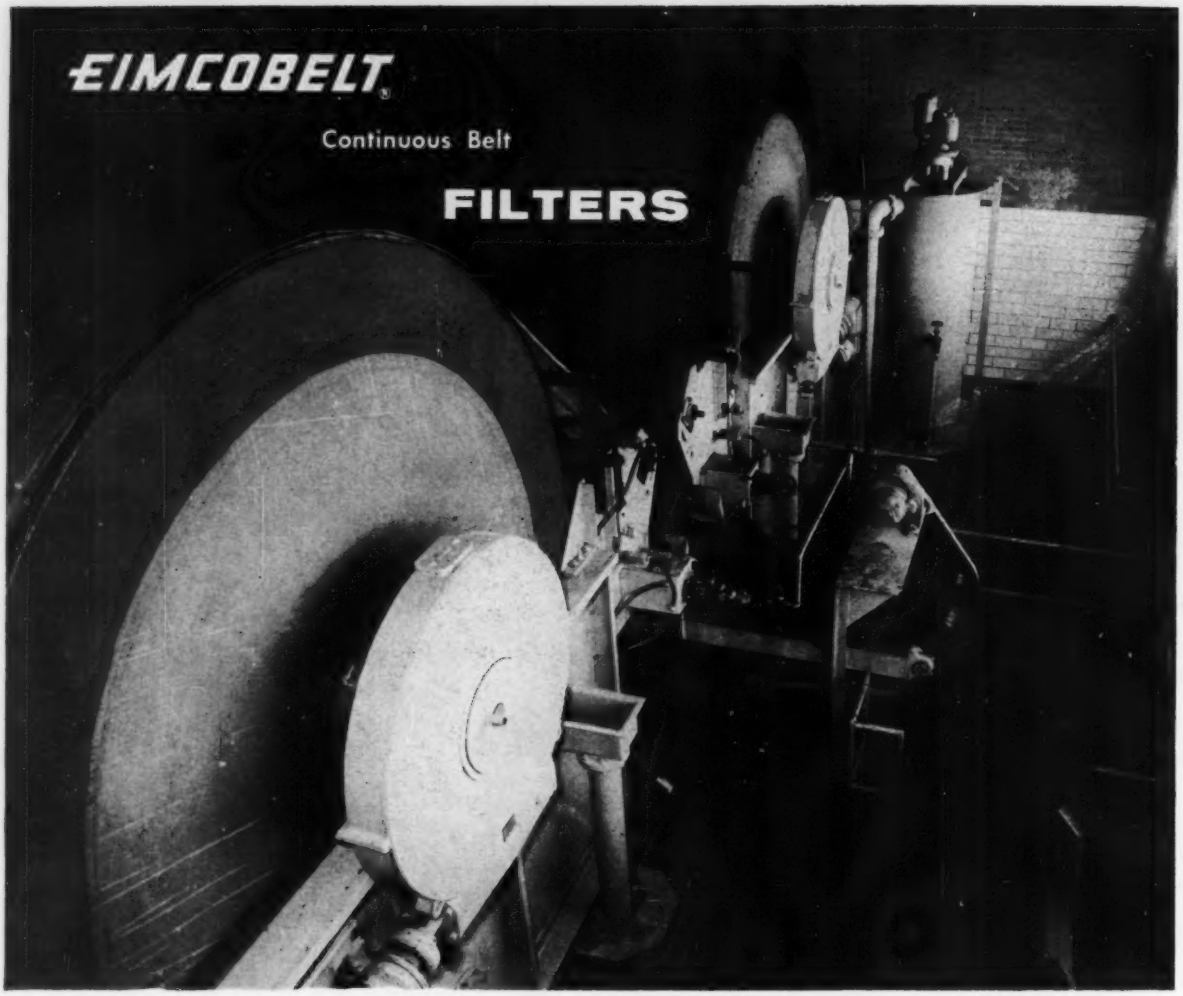

Rates of over 11 Pounds per Hour, Dewatering Raw Sludge, at Ogden

Cake production rate 11.2 Lb/Hr, dry weight solids; dry $FeCl_3$ and CaO additions 1.6% and 6.3%; cake moisture 69.2% — these operating results are typical of average monthly performance with EimcoBelt filters at Central Weber Sewage Improvement District, Ogden, Utah.

The two 11½-ft diameter by 12-ft EimcoBelt filters with synthetic fabric media handle an undigested primary trickling filter sludge that is probably one of the most difficult to filter in the United States. Influent contains packing house, plating mill and cannery wastes, often carries unusual amounts of grease, fats, feathers.

The cloth belt filter media has been in continuous operation for over 1½ years, still going strong, providing efficient operation with negligible maintenance. Continuous wash sprays maintain the media in an unblinded condition.

The Eimco representative in your area will be glad to show you and your consultants complete drawings of EimcoBelt filter stations that have established new, high performance records handling all types of sewage sludge. Call him, and write for Bulletin F-2053.

Consulting Engineers: Henningson, Durham and Richardson, Inc., Omaha, Neb.

Eimco's Process Engineers Division builds a complete line of equipment for clarification processing of sewage and industrial wastes.

EIMCO

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B-759

. . . . . *Am-Soc Briefs*

▶ ▶ Engineers united. . . . With engineers at the helm, the move across town to our new home, on United Nations Plaza, was surprisingly painless. The boxes (hundreds of them), with our Lares and Penates, our manuscripts and books and slide rules, packed on August 31, turned up in the proper offices in the United Engineering Center on September 1, and we were in business in a few hours. . . . Opening of the Engineering Societies Building over half a century ago touched off a three-day celebration. In soberer vein today, as befits these more sombre times, nineteen engineering societies took possession of their new home without fanfare, but with much appreciation of the generosity of members that has made possible their new headquarters — a proud symbol of the unity of the profession.

▶ ▶ Dedication of the United Engineering Center will take place on November 9. But before that — during the Annual Convention — out-of-town ASCE members will be given the grand tour — all the high spots from the impressive Chi Epsilon Conference Room on the 18th floor to the employees' cheerful cafeteria in the basement. Incidentally, the Chi Epsilon Room will be dedicated during the Open House.

▶ ▶ The UEC Open House for ASCE members is, of course, only one feature of the Annual Convention, back in New York this year for the first time since 1958. Quite literally, there will be something for every taste in the technical and social program that is being readied (September issue for details). As the center of an unprecedented building boom in the past decade, New York will be a dramatic backdrop for the Convention theme, "Metropolis — 1980."

▶ ▶ On a business note. . . . Only 7 percent of ASCE members have not finished paying their UEC pledges. If these could be paid now, ASCE would have its full $800,000 by dedication date. . . . Members who have been following recent issues of "Civil Engineering" are properly addressing Society mail to the United Engineering Center, 345 East 47th Street, New York 17, N. Y. Others, alas, are still using the old (now incorrect) address, which means a special trip to the Post Office each day to pick up bags of mail that cannot be delivered to an empty building.

▶ ▶ Hopeful augury. . . . This year, ASCE has gained 2,625 younger members — a 3 percent rise over last year and the highest number of recent-graduate admissions in ten years. These new Associate Members are also 63 percent of all 1961 civil engineering graduates of accredited schools.

Foundation Consultants:
Joseph S. Ward & Associates, Caldwell, N. J.

Diagram shows the lower end of a Vibroflot® machine in action to pre-settle sandy soil. Compaction is accomplished by a simultaneous saturation and vibration of the granular materials involved. During the application, fresh sand is added at the surface to compensate for the loss in volume caused by the increase in density (bearing capacity) of the compacted soil.

19th Factory Foundation on Sand

is this new container plant at Saratoga Springs, New York. 493 compactions by Vibroflotation,® adding about 2500 cu. yds. of fresh sand, were made to a depth of 20' below the footings to obtain a minimum 70% relative density.

High load bearing capacity was achieved by Vibroflotation® at these factory sites: a paper mill at North Bend, Oregon; a cheese plant at Clare, Michigan; a pulp mill at Terre Haute, Indiana; a ribbon and carbon plant at Holmesville, Ohio; a magnetic oxide plant at Hastings, Minnesota; a textile plant at Bethune, South Carolina; a cellulose plant at Jesup, Georgia; and a fertilizer plant at Fort Meade, Florida.

Write for Booklet C-31

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do you know that

The U.S. is reconsidering the idea of space platforms? The long-discussed method of building way stations in space as taking-off points for the moon and planets is being revived by experts who think it may have advantages over the present approach of firing manned capsules directly from earth. The principal argument for space platforms is that they could be developed several years before the super-boosters needed for direct trips will be ready.

▪ ▪ ▪

Reforestation does conserve stream flow? Twenty-five years after deforested slopes in New York State were replanted with evergreens, total stream runoff in three study areas was reduced as much as 0.36 in. per year, and peak discharges during the dormant season were reduced as much as 66 percent. Findings are revealed by U.S. Geological Survey hydrologists who have been working with state officials to observe the effects of reforestation on stream flow.

▪ ▪ ▪

Use of metal curtain walls is steadily gaining in popularity? Ten years ago there were fewer than a dozen buildings with metal curtain walls in the entire country. Last year they accounted for about 15 percent of the exterior walls installed, and forecasts indicate that, by 1963, 25 percent of the outside wall area of all non-residential buildings erected will be metal clad. These data are from the Olin Mathieson Chemical Corporation, reporting on a survey made by its aluminum marketing research department.

▪ ▪ ▪

There were fewer consultants and architect-engineers in 1960? Consulting firms, with $100,000 or more in new design work, dropped from a record 1,805 in 1959 to 1,794 last year. The number of architect-engineer firms with such volume dipped 5 percent, to 432. Consulting firms in the million-dollar class did better, matching the 1959 record of 895. Similarly, big architect-engineer firms dropped only 2 percent, in contrast to a 7 percent drop for the group as a whole. Our thanks for this to *Engineering News-Record.*

▪ ▪ ▪

Baseballs this year have more bounce? It's a scientific fact, according to Joseph Ward and Joseph DeSalvo, consulting civil engineers in New Jersey. The determinations were made for *Sports Illustrated* to bring up to date investigations made by the two ASCE members while on the Cooper Union faculty in 1953. Rebound was determined for balls from the 1952, 1953, and 1961 seasons by dropping them 26.7 ft on a steel plate embedded in concrete. Balls from the 1952 season bounced 8 ft, 1953 balls 8.62 ft, and 1961 balls 8.79 ft. The extra bounce might account for a 330-ft drive today being the equivalent of a 300-ft drive in 1952.

▪ ▪ ▪

Contractors, architects, and civil engineers are spending more and more time designing and building schools? In 1960 the tab for public school construction was over $2.5 billion, and more will be spent this year to keep abreast of growing educational needs. Our source for this, the U.S. Department of Labor.

▪ ▪ ▪

Natural gas pipelines offer a rich field for construction? In fiscal 1961 the Federal Power Commission approved outlays of over $852 million in the field. New facilities include 6,000 miles of pipelines and the addition of 337,000 hp of compressor capacity.

▪ ▪ ▪

Tax revenue was at an all-time high last year? The take in 1960 by all U.S. Governments came to over $113 billion, according to the U.S. Bureau of the Census. This amount was up $13.8 billion from the 1959 total of $99.6 billion. State and local tax totals increased 12.5 percent during the period, while federal taxes rose even more sharply—from $67.3 billion in fiscal 1959 to $77 billion in 1960.

▪ ▪ ▪

The U.S. will launch its biggest Antaractic research program in October? Some 200 scientists from universities, research institutions, and government agencies will undertake projects in Antarctica, under National Science Foundation grants totaling nearly $10 million. Geology, glaciology, mapping, meteorology, oceanography, and seismology will be among the subjects studied.

▪ ▪ ▪

The Peace Corps needs surveyors and road builders? A plea for more volunteers with technical training comes from national director, R. Sargent Shriver. Of 13,000 replies to questionnaires so far received, he said, only 6,000 applicants have taken tests and only 470 are either in training or overseas. While tests continue, about 1,000 are expected to be in training by January 1 and 2,700 by next June. According to Mr. Shriver, "there is no limit to the number needed."

more *go* for a nation on the go

Short paving train is led by two pavers riding side by side on subgrade; 12-ft lanes were later added adjacent to 24-ft lanes shown here, making 36-ft roadways.

Mechanical finisher pushes up an even 6-in roll of concrete – indication of uniform concrete and careful workmanship in a quality paving job.

The recently opened Tacoma Freeway is a vital link in the National System of Interstate and Defense Highways.

This Freeway is a six-lane controlled-access highway with two roadways of 36-ft width. Each was constructed by first placing concrete in a 24-ft lane, then returning and completing an adjacent 12-ft lane. Finishing was by mechanical finisher and burlap. Sawed joint construction was used with joints spaced every 15 ft.

The advantages of concrete construction – its smoothness, durability, skid resistance and superior night-time visibility – are augmented here by the Lone Star Air Entraining Portland Cement which was employed throughout. This modern cement enhances concrete workability, improves weathering characteristics and prolongs service life – advantages that go a long way toward making modern highways "going concerns" for many years to come.

Supervision: WASHINGTON STATE HIGHWAY DEPARTMENT. General and Paving Contractor, Ponders to 72nd Street: NORTHWEST CONSTRUCTION COMPANY, Seattle. General Contractor, 72nd to M Street: WOODWORTH COMPANY, INC., Tacoma; Paving Sub-Contractor: NORTHWEST CONSTRUCTION COMPANY, Seattle.

LONE STAR PORTLAND CEMENT

Lone Star Cement Corp.
New York 17, New York

CIVIL ENGINEERING

Where ——————should we stand on foreign aid?

RICHARD HAZEN, F. ASCE, Partner, Hazen & Sawyer, New York, N. Y.

Foreign aid is here to stay—for many years, I believe. The fact that it has not been successful in the past means that we must overcome its weaknesses and make it work. Consulting engineers, and others, have a stake, and a responsibility, in this program.

The Financial Section of the *New York Times,* September 3, 1961, included a personality sketch of William E. Knox, President of the Westinghouse Electric International Company. Knox has been active in promoting package deals involving atomic plants, power generators, and the like abroad. Knox decries the situation in which U. S. "amateurs" in foreign trade are competing with Russian professionals. He states that frequent changes in U. S. administration bring in a batch of neophytes, and he doubts that these neophytes can win against the professionals.

The present struggle between President Kennedy and Congress over appropriations for foreign aid stems from past failures, from general distrust of the program, and perhaps chiefly from the traditional position of Congress in the matter of appropriations. Congress, and the House of Commons before it, has always been jealous of the right to control the purse strings and it is proper that Congress maintain this position. However, while Congressmen have reason to doubt the effectiveness of the foreign-aid program, all of us can agree that year-to-year planning of large-scale projects is difficult, if not impossible. Ways must be found whereby our government can commit itself to carrying out long-term projects without depending on a favorable congressional vote a year or two hence.

Aside from military aspects, the foreign-aid program is designed to improve living conditions and economy in undeveloped parts of the world. The whole concept demands not just engineering, but good engineering. In my firm's field of water supply and sanitation, the effort is exemplified by the World Health Organization program to provide a safe water supply for every community. This is a big undertaking and yet it is one that I believe will be accomplished in a relatively few years. The global water supply program can be carried out successfully only if common sense is applied to the projects. Safe water supplies around the world can be provided without building replicas of facilities in the United States and Europe. Simple but sound water supply facilities will suffice for many years in many, many places.

Mistakes in several areas

In reviewing water supply and sanitary engineering projects abroad, it seems to me that we have not done the best that could be done in several important respects. I cite particularly:

1. Overenthusiastic appraisals as to need and what the people will actually be able to operate and support.

2. Emphasis on the opportunity to make a fast dollar by engineers and equipment vendors. (This criticism ap-

plies to the United States but fully as much to European countries.)

3. Acquiescence in demands by foreign officials for a "showpiece." Water mains and sewers are not particularly glamorous or vote-getting. A politician is likely to insist on something the voters can see. Incidentally, this kind of demand is common in the United States as well as abroad.

4. Failure to take full advantage of local resources in the planning and designing of facilities. The undeveloped nations of the world have almost no currency with which to enter the foreign trade market, and all efforts should be bent towards providing the needed facilities with as much local material and labor as possible.

Wide opportunities

Lest anyone think I speak only of sanitary engineering projects, it is worth recalling that the Rural Electric Administration, regardless of how one feels personally about its philosophy and methods, has done more for sanitation in the United States than most "public health" programs. I feel sure that there are opportunities in the foreign-aid program for nearly all branches of engineering.

Where does the foreign-aid program fall down? Probably the most important difficulty is politics—national and international. It is hard to give money away and still keep your friends. No one should assume that the International Cooperation Administration (ICA) job is a simple one. All of us who have worked abroad even a little have seen the pressures, the special demands, the underhanded methods to influence decisions, and incidents of petty graft and grand larceny.

Better engineering solutions

Probably the solution to these political and organizational problems lies in the establishment of a firm policy by our government, and in getting personnel to administer it who are strong enough to insist upon compliance and to arrive at reasonable and practical solutions. However, in addition to these overriding political considerations, it seems to me that many of the programs and projects have been weak in regard to engineering. Some of the more important factors are:

1. Misconceptions at the start as to what can be accomplished in a reasonable time and at reasonable cost. Untrained or naive enthusiasts get excited about a project, talk about it to local government officials, and from then on it is almost impossible to bring the project within bounds. Any cutting back on the original idea is politically impossible.

2. Inadequate estimates of what a project involves and will require for its satisfactory completion, and what it will cost. Some projects get started on a shoestring. Engineers' and contractors' performances are poor, the funds run out, and the project bogs down. This kind of thing, nurtured and hidden in a large bureaucracy, inevitably brings a condemnation of the U. S. foreign-aid program and its effectiveness.

3. Empire building within ICA and other foreign-aid agencies. This is natural in any organization and it is reasonable to expect a certain amount of feather-bedding in all organizations of considerable size. Perhaps more important is the fact that some positions requiring forceful men of good practical judgment are filled by engineers or retired public officials who are not accustomed to pushing a project to completion. I do not criticize the technical competence of these people but some of them obviously are in the wrong job.

What should the American Institute of Consulting Engineers do about the foreign-aid program? For a starter, I would like to present the following suggestions:

1. First and foremost, we members of AICE must recognize that engineers and consulting engineers must take an active part in the foreign-aid program and in seeing that the program is as effective as possible. This is no time to "let George do it." If we do so, we can be sure that incompetents and non-engineers will be making the decisions that we should be making.

2. Sell to ICA and other foreign-aid agencies, the importance of a competent review of proposed projects early in the game. An experienced person can in a fairly short time sift out the essentials, determine what the principal unknowns are, and how significant they will be in the final answer; he can establish the general feasibility of a project much better than a group of inexperienced or incompetent engineers sent into the field to collect details. This is not a proposal for off-the-cuff engineering; engineers must be careful in the statements they make. It is largely a matter of approach. If the engineers engaged, and the ICA, will recognize the basic purpose of this preliminary review and understand that the engineer cannot be held responsible for details he has not had time to investigate, much can be gained.

I am sure that this approach to the problem would in many cases cost a great deal less than the extended investigations that have been made in the past, and it would eliminate the necessity for much political backtracking and face saving. A corrollary to this proposition is that we engineers should accept such engagements if offered by ICA even though they will not be real moneymakers.

3. We must recognize that the United States and all its citizens are going to be involved in foreign affairs more and more, and if engineers are to take their rightful place in the program, they are certain to do more foreign engineering in years to come. This is important to us but much more important to the younger men in our offices, who will take over in years to come. Rather than point out the difficulties in foreign work, it seems to me that we should encourage the younger men to get the benefit of experience abroad and to acquire a more international viewpoint of things on this planet.

In line with this, my firm has taken up with ICA the possibility of our staffing, on a contract basis, a regular job in some foreign-aid country for two years or more. We favor the contract approach because it would permit us to back our man in the field with technical assistance and advice if he gets beyond his depth. We have not yet been successful in this, and I do not know that the idea is acceptable. We have also suggested the possibility of lending one or two young men to the ICA for a definite period with the expectation that they will come back to us when they have completed their tour of duty.

We must be ready to help

4. We should be ready to help ICA, CARE and other agencies with advice, suggestions, etc., when asked to. Recent talks with CARE officials developed the fact that they frequently are looking for judgment and advice on a particular project and would like very much to have the names of specialists they can call on. This is not lucrative employment; it would involve a few hours of work from time to time and obviously would not be revenue-producing.

In conclusion, I feel strongly that the international situation demands our active participation today just as much as it did when we were in a hot war with Germany and Japan. Business-as-usual cannot continue to be the standard of the day. The foreign-aid program needs the leadership that engineers can give. Will not neglect of this opportunity mean that we have failed as a profession?

This talk was presented before a New York meeting of the American Institute of Consulting Engineers in September.

Photo-interpretation shows increasing usefulness

J. D. MOLLARD, M. ASCE, President, J. D. Mollard & Associates, Ltd., Consulting Engineers, Regina, Sask., Canada

To indicate future trends in photo interpretation for engineering projects, more than 550 consulting assignments carried out by the writer's firm in the past five years are here analyzed. All but a few concern civil engineering and engineering-geology studies. They were performed in the main by two experienced photo interpreters.

Photo interpretation and ground methods of obtaining terrain data are not independent; rather, they are interdependent. Intelligently combined, they provide an effective way of assessing the terrain with minimum time, effort, and cost.

I will not delve into the techniques of interpreting aerial photos or dwell upon how the derived information is applied. These aspects have been considered at length elsewhere.[1,3,4,6,7,8] See the accompanying bibliography. My own thoughts on such matters are covered in a number of selected papers. (See references 2 and 9 to 23, inclusive.)

Most common engineering applications

Among the 550-odd consulting assignments referred to above, the most common requests for photo-intrepretation assistance were as follows:

Purpose	No. of Assignments
Location of sand and gravel deposits	217
Location of ground-water sources, mainly for municipal water supplies	56
Dam-site and reservoir studies	53
Terrain analysis applied to highway location	51
Location of various types of select earth materials other than sand and gravel	40

These five applications represent nearly three-quarters of all the jobs undertaken. The assignments were mainly office studies. Some were field checked by us; many were not. Although we prefer doing our own ground checking in company with the client, the client usually wishes to carry out his own follow-up field investigations for reasons of cost.

Locating sand and gravel deposits. In the course of the 217 sand and gravel searches, just under 9,000 granular-material prospects were mapped in a total examined area of 120,000 sq miles. Searches were requested by federal and provincial highway departments, railway companies, city engineering departments, rural municipalities, counties, sand and gravel suppliers, ready-mix concrete operators, and speculators. See Fig. 1.

Sand and gravel are of course nonrenewable resources. Known sources are rapidly being depleted and more distant sources must be tapped.[5,10]

In 1960 the number of requests for air-photo gravel searches increased 50 percent over 1959; twice as many searches were made in 1960 as in 1958. This accelerating trend can be expected to continue.

Locating ground-water sources. Of the 56 ground-water searches listed, 31 were made in 1960. These data suggest a very marked increase in this field of photo interpretation. With our steady increase in population—particularly urban—we can expect the present high demand for new and improved municipal-water facilities to continue. For example, in western Canada, towns that do not already have water and sewer facilities are demanding their installation as soon as possible. High initial costs frequently prohibit construction of surface-water schemes. Consequently a search must be made for ground-water sources. It is here that photo interpretation can make a significant contribution.[21] See Fig. 2.

The photo interpreter should keep in close touch with test-drilling operations and aquifer-testing investigations at sites he has selected for exploration. His success in finding ground-water sources should improve as experience is gained. These studies often involve selection of sites where induced infiltration or artificial recharge can be considered.[21]

Location of select earth materials other than sand and gravel. These air-photo searches are usually made in places where select-material deposits are hard to find by ground methods alone. Air-photo searches are commonly made for quarry rock; for impervious, semi-pervious and pervious materials for use in zoned earthfill dams; for blender sand for use in washed, fine concrete aggregate; for binder clay; for filler sand for use in bituminous road construction; for boulders used in rip-rapping large earth dams; for filter sands; for clay for stabilizing roads built on sand dunes; and for subbase, base-course, and improved subgrade materials for use under highway pavements.[20,14,20] No single request for assistance has increased so rapidly as this one. In 1960, for example, 29 air-photo assignments of this nature were carried

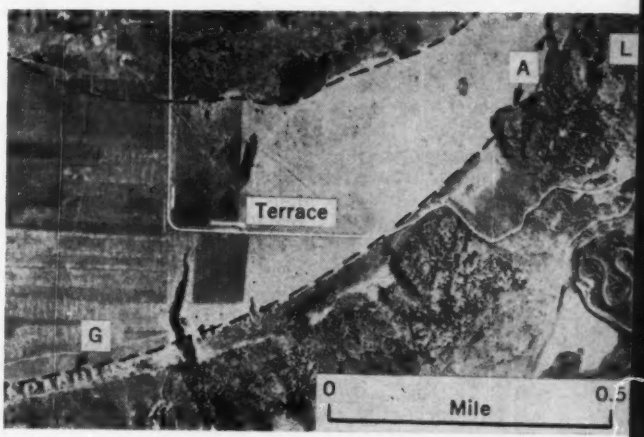

FIG. 1. Area outlined was mapped in search for top-quality coarse aggregate. Main identifying elements are gully shapes, G, and terrace position. Indents in terrace at A result from long continued seepage and removal of materials above the contact of the gravels and underlying impervious soils. Slumps are seen at L.

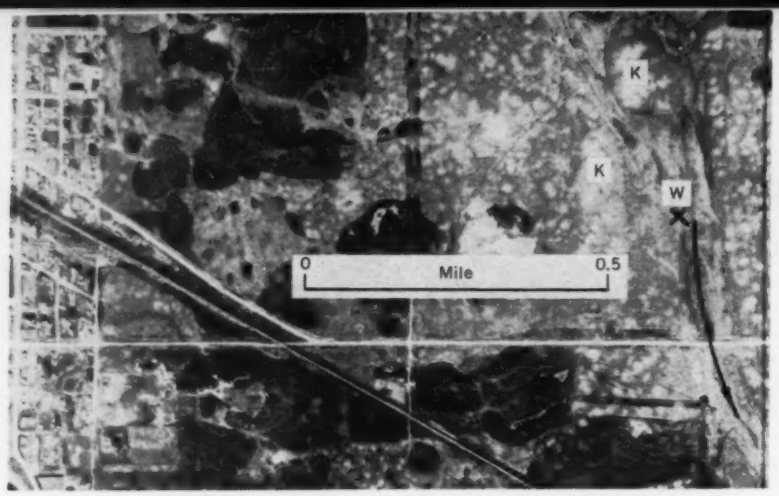

FIG. 2. Water-well test site for town at left was located initially at W by an air-photo study, later checked on the ground. Air photo study suggested a granular deposit in an intermittent creek bed (arrow). Hills marked K are kames. A gravel stratum 34 ft deep was found on drilling, the lower 22 ft yielding an ample supply of good drinking water.

out compared with a total of 11 in the preceding four years. In part this trend reflects increased activity in highway construction and in major earthfill dam construction.

Less common applications

The following list of less common applications is taken from our files of consulting assignments. Applications are arranged in descending order of frequency.

Photogeologic mapping for the oil and mining industries[15]

Pipeline-location studies[17]

Transmission-line location studies[22]

Selection of sewage-lagoon sites[20]

Landslide and related slope-instability studies[9]

Developing prebid tender information for contract-cost estimating[23]

Drainage mapping and hydrologic studies[25]

Terrain mapping associated with siting new towns and resort areas[18]

Estimation of terrain conditions along proposed railways[28]

Irrigation—selecting potentially irrigable areas from the standpoints of soil, topographic and drainage conditions; mapping salinity levels and areas with subsurface drainage problems[9,32]

Bridge and industrial site-selection studies[16]

Legal disputes, usually involving flooding or erosion damage

Mapping rock outcrops and estimating depth to bedrock (classed in groups)[32]

River-intake assessment where scour, sedimentation and riverbank instability are potential problems[29]

Beach erosion and related slope instability[9]

Although these applications may be requested only a few times each year, they nonetheless lend themselves to photo-interpretation techniques. The comparative rarity of requests for assistance probably derives mainly from a lack of knowledge of benefits that can result. At present we may expect anywhere from 1 to 5 of these jobs each year. Moreover there appears to be very little consistency in the demand for these studies from year to year.

It is probable that the demand for the 15 types of studies listed above will increase materially over the next 10 years. Also, in the future I believe air-photo hydrological studies will become commonplace along all new highway-location routes. Contributing drainage areas, watershed slopes, land use, vegetation and other factors governing runoff can be extracted directly from the air photos and used in the design of culverts. The demand for these studies is likely to increase sharply for the appraisal of small watersheds—say, for those under 1,000 acres.

Other applications

Many engineering applications of photo interpretation that I feel have a bright future are not included in our job-inventory files. Yet we have frequently held discussions with engineers concerning such studies. Several are worth mentioning as a possible index of future trends.

River-basin studies. In a basin-wide investigation of a major river for multiple use, the river and its principal tributaries are commonly flown to a photographic scale that shows the entire valley as well as all areas that would be affected by impounded waters. Strip mosaics are then assembled, using the new high-quality contact prints. In this type of assignment the photo interpreter normally works as a member of a professional team, investigating feasible-looking dam and reservoir sites. Aspects studied include power sites, irrigation, recreational potentialities, municipal water supplies, and the effect of new reservoirs on surrounding ground-water levels. In each of these the photo interpreter can make a significant contribution.[9,13,14,30]

And the greatest contribution can be made if the photo interpreter has sufficient experience to: (a) confidently identify geomorphic land forms and predict the dominant surficial materials in them; (b) reconstruct the sequence of geologic events as they affect the planning of follow-up field work; and (c) interpret the significance of geologic events and surficial materials inferred from the aerial photographs.

Geothermal-power sites. In the future, photo-interpretation techniques will, I believe, be applied to the discovery of possible geothermal-power sites inasmuch as these sites are controlled by faulting, the traces of which are often difficult to identify by observers on the ground.

Fracture-trace mapping. In places, fracture traces can be discerned in air photos—even where the bedrock surface is masked by surficial materials.[8] Surface depressions may form that correlate with joint and fault systems in the underlying bedrock.[18] Knowing the position, dominant directions, and variations in intensity of these fracture traces, the engineer can do a better job of laying out bedrock grouting programs; predicting ground-water movement and, perhaps, the direction of secondary porosity; determining slope-instability conditions influenced by water-filled fissures; and recommending procedures for certain rock-blast operations.[27,28]

Periodic photography. For some time periodic aerial photography has been used to estimate such things as tree clearing in large reservoirs for progressive payments to contractors, to estimate the volume of rock excavated in open-pit mining, and to inventory large man-made stockpiles of sand and gravel or logs for the pulp-and-paper industry. Also, periodic photography may be used to visually record construction conditions at particular times and stages of contract operations. This is a good way to keep track of construction operations for progressive payments to contractors. The photos may also be referred to later for "buried evidence" if post-construction litigation or misunderstandings develop. Periodic strip photography can be used to evaluate progressive deterioration of highway pavements.[15]

Site selection in northern areas. In this application great things are forecast. In the north, the physical environment is harsh and the selection of new town sites requires recognition of the nature and distribution of terrain features having various engineering characteristics. Much has been written on the photo interpretation of muskeg and permafrost but proportionately little has been actually applied. In interpreting terrain for new community development, the air-photo observer

must pay special attention to anticipated construction problems and types of structures, to probable construction methods, and of course to economic considerations.[19]

Surveys for less-developed countries

It is said that the economic wealth of a nation is based on its proven and developed natural resources. Suspected resources do not represent a capital asset. Today, more than ever before, there is urgent need to discover and catalogue the world's natural resources.

A few years ago an air-survey firm in Canada carried out a major photo-interpretation assignment in West Pakistan—one of the largest of its kind undertaken anywhere. To obtain the same map information by conventional ground methods would have taken several decades. Air-photo identifications at predetermined localities were field checked by helicopter, jeep, and men on camels. A similar photo-interpretation survey is now in progress in Ceylon. This assignment involves possible water-power sites and transportation routes. It includes regional planning and air-photo mapping of information on minerals, forests, soils, and land use.

I was technical advisor to the governments of Ceylon, West Pakistan, and Canada on these air-survey programs when they were first organized,[10,11] and consequently have followed their execution closely. They appear to have been most successful. Photo-interpretation studies properly coordinated with ground investigations can be readily adapted to the needs of less-developed nations.

Education in photo interpretation

Lack of understanding of the role of photo interpretation is often encountered in preliminary discussions with clients. Only when the photo interpreter and the person using the interpreter's information both have a good understanding of what is involved, can the photo-interpretation assignment be successful. If either party does not appreciate the nature and implications of the assignment, then a multitude of unpleasant situations can develop. Both, for example, should realize that photo interpretation is basically a tool—a means to an end rather than an end in itself—and that follow-up field work is a necessity in all but the exceptional case.

Instruction courses in photo-interpretation techniques were not available to large numbers of college graduates now employed in government and industry. To enable practicing civil engineers, engineering geologists, foresters, and agrologists to gain a better understanding of these techniques I have prepared and presented six short courses in the past four years. Over 250 participants, mainly graduate civil engineers, attended these lecture and laboratory sessions—demonstrating a growing interest in photo interpretation by government and industry.

We need more instruction in our universities—especially at the senior undergraduate and postgraduate levels. Moreover, this instruction must be handled by qualified personnel with practical experience in air-photo interpretation. Air-photo libraries at universities must be large enough to include a wide variety of geomorphic landscapes. Following formal courses in the identification of landscape features, the student should tackle a wide range of mapping assignments in the laboratory. He must check his work, and the best procedure is to correlate air-photo and ground details himself.

The beginning student should be told, for instance, that the volume of data derivable from air photos and the accuracy of the forecasts vary from fact to fancy depending on the ability, training, and experience of the interpreter and his familiarity with the region under study. Interpretation is basically an art that is guided by background training in the earth sciences, especially geomorphology.

Also, the lectures should explain that the amount and accuracy of the data obtainable depend in no small way on the interpretability of these data, regardless of the experience of the interpreter. And it must be stressed that air-photo interpretation is rarely expected to stand alone. As with any technique, it should be employed wherever it can best serve in attaining a particular objective. In general, it finds its principal role in the prefield stages of civil engineering and engineering-geology studies.

Finally, any educational program must keep abreast of developments in the materials and tools used. I refer mainly to color photography, to special-purpose photography, and to filmfilter research. In future I believe the benefits of our interpretation will be expanded materially through photographs flown to specified scales, using selected film and filter combinations, with a particular type of data identification in mind.

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Steel casing is installed under a railroad fill. A Crose road boring machine is attached to the steel casing.

Encasement of water-line crossings

Standard construction specifications sought

LEO LOUIS, JR., F. ASCE

Chairman, AWWA Committee on Pipeline Crossings of Highways and Railroads

President and General Manager, Gary-Hobart Water Corporation, Gary, Ind.

Encasement of water-line crossings is one aspect of the work now being undertaken by the Committee on Water-Line Crossings of Highways and Railroads of the American Water Works Association. A discussion by R. Robinson Rowe, F. ASCE, plus interest shown in the subject both by water utility men and state highway engineers led to the formation of this committee in 1960. Mr. Rowe's address was given in a panel discussion concerned with highway and railroad crossings of water lines at the Annual Conference of the AWWA in San Francisco, July 15, 1959.

The members of the committee recognize that its primary purpose is to evolve workable construction specifications or standards that can be used by all water utilities for crossings. If such standards can be adopted by the water works industry, they will be of benefit not only to the members of the industry but also to railroads and highway departments.

That phase of the crossing problem to be discussed here is encasement. What is the primary reason for encasement? 1. Is it to carry the load? 2. To prevent shock and vibration from being transmitted to the carrier pipe? 3. To permit water to escape from a break or leak in the pipeline without damage to the roadbed, if such a leak occurs under a railroad or highway pavement? 4. To enable the leak to be repaired without excavating and disrupting traffic on the railroad or highway?

The railroad or highway engineer is concerned with preventing damage to the roadbed or pavement and the water utility engineer is concerned with preventing damage to the pipeline and disrupting service to his water customers. But they should both end up at the same place!

Given a choice, water-works men would probably prefer to construct pipeline crossings in open trench and without a casing if certain conditions

could be met. However, it is realized that traffic must be maintained. While carrier pipes can be designed to withstand the load, and with enough flexibility to prevent breaking or leakage under traffic, encasement will be required in most cases where heavy rail or highway traffic is a factor. In my own experience at Gary, Ind., we are content to install casing pipes when passing under a railroad or a heavily traveled highway.

Our biggest problem has been with the differing specifications of the various railroad engineering departments. Eight or ten different railroads pass through or near Gary. In one case we planned to install a 36-in. water main under three different railroad rights-of-way, and each of the three wanted the job done in a different way. One would allow us to jack a large-diameter casing through, another would permit tunneling with liner-plate encasement, and the third insisted on open-trench construction with bridging to support the track while a casing was installed.

For service lines

Water mains come in all sizes, of course, and we encounter all types of soil conditions. For service lines rather than transmission mains, that is, for pipes of 2-in. diameter or less, the job may be very simple. Under streets or highways, if the base is sand, it is possible to air-jet a hole with an air-lance and pull copper pipe back through the hole. Where the base is clay, a 3-in. auger powered by an air motor can be used, and the service pipe can be pulled into place when the auger is withdrawn. Under railroads, a 2-in. or 3-in. casing has been installed with an auger and the service pipe pulled through the casing.

For mains, which are usually 6 in. in diameter and larger, different railroads have specifications that vary in some respects, but all require a casing with the main inside. We have used an augering machine known as the Crose road-boring machine, manufactured by the Crose Manufacturing Company. This equipment consists of an auger driven by a gasoline motor, the entire machine being clamped onto the steel casing pipe, with the auger operating through the casing.

First a cable is drawn through a pilot hole augered beneath the tracks and secured to a deadman anchor on the opposite side. Then, by means of a winch on the machine, the casing and the augering equipment are pulled into place as the auger removes the soil ahead of the casing and carries it back through the casing. With this equipment, a casing up to 30 in. in diameter can be installed. Also, a larger machine is available for borings of larger diameter.

For large mains

For mains of larger diameter, water utility companies ordinarily employ contractors who specialize in casing work. Concrete or steel pipe of large diameter can be jacked into place as the soil is removed by workmen operating inside the pipe. Or steel liner plate can be installed in place as tunneling operations proceed. In extreme cases, a masonry or concrete tunnel or gallery can be constructed. Then the carrier pipeline can be jacked through the casing, the pipe being supported on skids or cradles of some sort.

If specified, grout can be forced into the annular space between the carrier pipe and the casing to complete the job, although many engineers feel that this defeats the purpose of the casing since water cannot escape if a break occurs. Also the pipe cannot be removed in case of a break.

The Indiana State Highway Department does not have specific requirements for the encasement of pipe under pavements, but ordinarily it does prohibit cutting of the pavement and installation of water mains in open cut. It usually requires that a casing be used, and where sand underlies the pavement, a casing is necessary. Where clay is encountered, a hole can be bored without a casing and the water pipe can be pulled or jacked into place. We do this under city streets on occasion. For augering operations and installation of casings, we use the Crose equipment previously described.

One state highway department has recently permitted the installation of two types of pipe without encasement —ductile iron pipe in diameters from 6 to 20 in., equipped with compression-type rubber ring joints, and prestressed, steel-cylinder, concrete pressure pipe with the same type of joint. This can be done where clay soil is encountered; the hole can be augered under the right-of-way, the pipe pulled or jacked through, and the annular space filled with mud or cement grout.

Ductile iron pipe

Ductile iron pipe is a fairly new commercial product; it was first announced to the field in 1949 by the International Nickel Company. Several pipe manufacturers are now making and selling this pipe. The iron in it contains spheroidal graphite particles instead of the flake graphite found in gray cast iron. This structure decreases brittleness and minimizes cracks under stress, thus producing a more ductile and flexible pipe. The bursting strength of the pipe is increased while it retains its properties of anti-corrosiveness. This ductile iron pipe is used by our company for any major street crossing where encasement is not necessary.

The AWWA committee hopes to collect all available information on water-main crossings of highways and railroads, and from this information to evolve standard construction specifications for the guidance of water utility companies. Many problems are involved because of the many agencies concerned with the problem. But if our eventual objective is attained of providing the greatest safety to both the water utility and the railroad or highway, all parties should be able to agree on such a standard.

(This article is taken from Mr. Louis' paper presented at the ASCE Phoenix Convention, in the symposium on Pipeline Encasement Practice at a session of the Highway Division.)

Auger driven by a gasoline motor is attached to steel casing pipe. Auger operates inside the casing, removing the soil and carrying it back through the casing.

Entrance to the United Engineering Center, 345 East 47th Street, New York 17.

The employees' cafeteria surrounds the interior court at the lower level.

ASCE Executive Wisely sits at his new desk. Windows overlook United Nations Plaza.

The United Engineering Center became a reality early in September when 19 professional engineering groups opened their headquarters in the new building. The structure, on United Nations Plaza overlooking the East River in New York, is now the focal point for some 300,000 professional engineers, probably the greatest aggregation of engineering talent ever brought together.

At the ground-breaking for the structure, former President Herbert Hoover, a member of three of the societies that occupy the building, suggested the far-reaching purposes of the Center in these words:

"Within the [engineering] societies is a constant exchange of discovery, improvements and experience . . . findings printed for all the world to see. . . . The engineer starts with these stimulants to imagination . . . makes a plan on paper. Then he moves to its realization in cement, in metal, in stone and in energy. Thus he brings jobs and better homes. This is high privilege. . . .

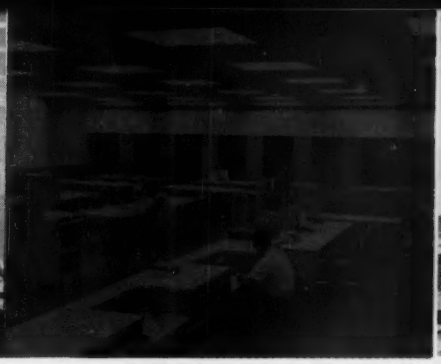
"This great building is to facilitate these goals. It will play a great part in American life. It will serve all mankind."

The building has been constructed at a cost of about $12 million. Much of the money has come from the contributions of many thousands of individual engineers, augmented by substantial gifts from industry. The enthusiastic participation of so many individuals and organizations, including student groups and many engineers in distant lands, is a most gratifying expression of the faith of engineers and others in the future of the profession.

HAL W. HUNT, F. ASCE, Editor, Civil Engineering, ASCE, New York, N. Y.

UNITED ENGINEERING

Editorial assistants and secretaries on ASCE publications now have adequate space.



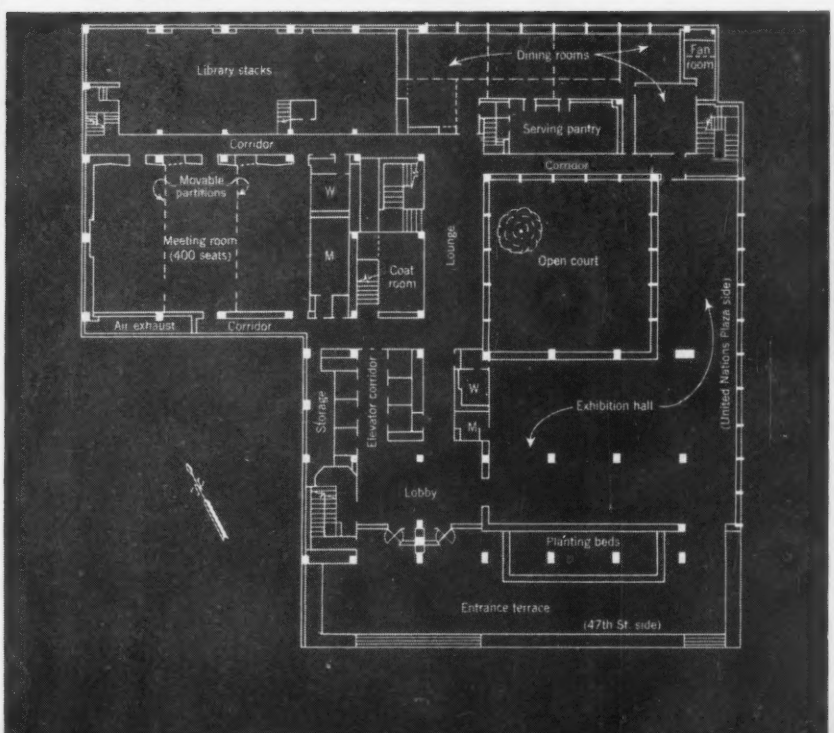
The Engineering Societies Library has spacious quarters in the United Engineering Center.

Dominating the view from ASCE office windows is the United Nations Building.

Funds were raised for the building —and its overall planning and construction supervised—by the United Engineering Trustees, Inc. This control group was established in 1904 to administer the old Engineering Societies Building, then in a planning stage, and has continued since to control the jointly owned and operated facilities such as the building and the Engineering Societies Library. Authority is vested in a board of fifteen—three from each of the five Founder Societies. ASCE's representatives on the board are Charles B. Molineaux, D. V. Terrell and William H. Wisely. R. E. Dougherty, Past President ASCE, is chairman of the Member Gifts Campaign of all the societies.

The $800,000 quota assigned to ASCE for the building fund was raised by cooperation of all the Sections, their Branches and many of the Student Chapters. Money was received from engineers in a number of other countries. About 50 of the Sections met their quotas in full, Kentucky being the first to go over the top and Southern Idaho contributing twice its assigned amount. Executive Secretary

CENTER



Above: The United Engineering Center as seen from United Nations Park.

Far left: Helicopter view of the United Engineering Center looking toward the UN park and major buildings. Photo courtesy Port of New York Authority.

FIG. 1. (Near left) Plan of first floor for United Engineering Center includes meeting room, dining, and exhibition facilities. Entrance is on terrace.

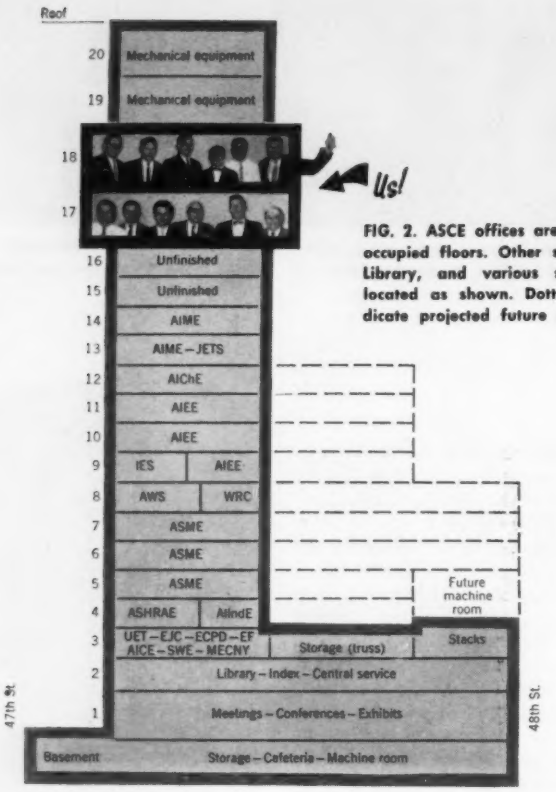


FIG. 2. ASCE offices are in two top occupied floors. Other societies, the Library, and various services are located as shown. Dotted lines indicate projected future construction.

Wisely and recent presidents of ASCE —notably Friel, Howson and Marston —devoted much of their time to the successful ASCE Member Gifts Campaign. Nearly all the societies occupying the new building have successfully met their quotas.

Despite the widespread campaign, only one-third of ASCE's members have contributed. Because of some additional work and minor changes, more money is required to make the building free and clear of encumbrance. Especially for those who have not yet had a share in the building, this is an opportunity to make a contribution that is needed and will be appreciated. (Just make out a check to United Engineering Trustees, Inc., and mail it to Executive Secretary William H. Wisely, ASCE, United Engineering Center, 345 East 47th St., New York 17, N. Y.) Your Local Section will be credited for your contribution.

The United Engineering Center will open a new era to the engineering societies and to their headquarters staffs. The move will bring into a central building five groups that were not in the Engineering Societies Building. For the first time the societies will have lunching facilities within their own building, thus bringing their staffs into daily contact. Also the building will provide a convenient meeting place for visiting engineers.

Basic design pattern

In keeping with the style of the United Nations area of which it becomes a part, only a low structure covers the block front from 47th to 48th Streets while a tower, which houses society offices, rises to a height of 20 stories. The entire building is set back 27 ft from the 47th Street side, creating a paved and landscaped terrace, which is raised slightly above sidewalk level.

The building is an imposing structure of glass and limestone rising from a granite base. Stainless-steel mullions, column covers and window frames accentuate the gray-blue color motif used in the glass spandrels for the full height of the building. The same gray-blue is carried into the structure in various interior details.

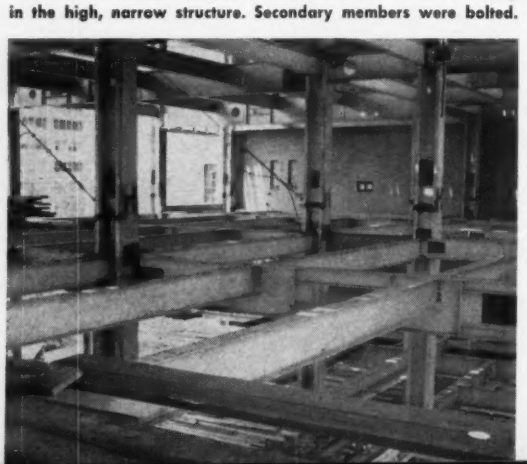
Most of the facilities serving all tenants of the building and the public are contained in the low block, which covers almost the entire property of 37,000 sq ft. This block is two stories high on the 47th Street side and three stories on 48th Street because of the slope of United Nations Plaza. The block is pierced by an interior court, open to the basement level for light.

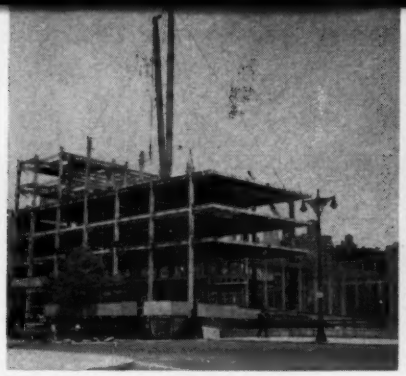
The main entrance to the structure is from the 47th Street terrace into a lobby walled in Georgia Cherokee marble, with floors of bluish gray terrazzo. On the United Nations side of the lobby is an Exhibition Hall. Here it is planned to have changing displays illustrating the many contributions made by all the branches of the engineering profession to world progress. The Exhibition Hall has an area of 6,000 sq ft with a ceiling height of 15 to 22 ft. Glass from floor to ceiling, the full length of the United Nations Plaza side, provides a show window for the passer-by. Provision has been made for flexibility in the lighting of displays.

On this floor also is a meeting room for 400 people, which can be subdivided by moving partitions into three rooms of equal size. Special

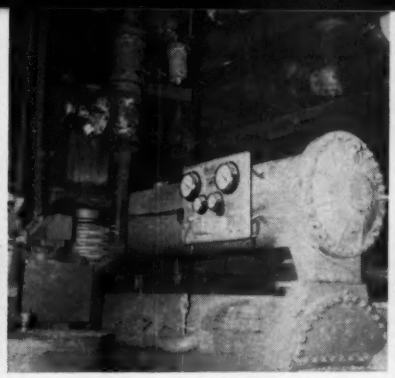
Space was saved by use of boxed columns, shown here under fabrication in the shops of the Dreier Structural Steel Co.

Columns and main beams were welded for stiffness and economy in the high, narrow structure. Secondary members were bolted.





A guyed erector's derrick set steel for two floors; it was then "jumped" to the next level as erection proceeded.



Cooling for the new building is provided by Carrier air-conditioning equipment in two separate systems.

Mineral-fiber ceiling board keeps down noise and makes air-conditioning piping accessible. Waldvogel Brothers photo.

provision is made for the presentation of illustrations from a projection booth.

From the lobby four automatic elevators will serve the needs of some 650 people (exclusive of service staff) who are expected to occupy the building. Space is provided for two more elevators, which will be required when additions are made to the structure. Corridors lead to private dining or conference rooms with capacities varying from 20 to 100 persons. The private dining rooms are served by a pantry connected with the main kitchen below by means of an electric dumb-waiter and a stairway.

Below the main floor, but on the 48th Street level, is an employees' lounge and dining room seating 250. This is placed around a landscaped sunken court. The kitchen, service entrance and off-street truck dock are on the 48th Street side. Also on this level are the switchboard, building maintenance shops, and the like. A small subbasement is provided under part of the maintenance area.

Library and society offices

For easy access, the library reading room is located on the second floor; it has seating space for 80 readers. Bound volumes of engineering magazines are in stacks at one end of the room. A special reference "bar" is arranged for those using the Engineering Index and similar reference volumes. Provision is made for storing an ultimate quarter of a million volumes on engineering subjects in a five-tier stack adjoining the library. A special elevator serves the stacks.

The individual societies have their offices in the 69 x 139-ft tower section. Each group has been allowed to take as much space as it wishes at a cost of $4.50 per sq ft. This figure is planned to take care of maintenance and to accumulate a depreciation reserve. At present, the space taken by individual groups varies from one room to three complete floors of the tower. ASCE will occupy the two top usable floors—the 17th and 18th (the 19th and 20th floors, actually four stories in height, house mechanical equipment). The 15th and 16th floors are not finished and are available for expansion.

Another provision for expansion is in a planned connecting structure on the northwest side of the building over the library and book stacks, where as much as 8,500 sq ft can be added per floor from the third through the eighth floors, and 6,000 sq ft per floor from the ninth through the twelfth.

Groups to occupy the United Engineering Center

Group Desig.	Full Name	Year Founded	Membership, Mid-1961	UEC Fund Quota	N. Y. Staff
ASCE	American Soc. of Civil Engrs.	1852	48,000	$800,000	87
AIME	American Inst. of Mining, Metallurgical and Petroleum Engrs.	1871	37,150	500,000	53‡
ASME	American Soc. of Mechanical Engrs.	1880	49,500	800,000	140
AIEE	American Inst. of Electrical Engrs.	1884	55,000	900,000	95
AIChE	American Inst. of Chemical Engrs.	1908	22,000	300,000	45
	(The above are known as the Founder Societies)				
ASHRAE	American Soc. of Heating, Refrigerating and Air-Conditioning Engrs.	1894	17,800	250,000	40
MECNY	Municipal Engrs. of the City of New York	1903	660	†	1
IES	Illuminating Engrs. Soc.	1906	9,900	75,000	22
AICE	American Inst. of Consulting Engrs.	1910	275	25,000	2
AWS	American Welding Soc.	1919	12,800	60,000	38
WRC	Welding Research Council	1935	*	*	7
AIIndE	American Inst. of Industrial Engrs.	1948	9,700	70,000	6
SWE	Society of Women Engrs.	1950	470	7,000	1
JETS	Junior Engineers Technical Society	1950	*	*	5
EIS	Engineering Index Service	1884	*	*	30‡
UET	United Engineering Trustees	1904	*	*	8
ESL	Engineering Societies Library	1913	*	*	23‡
EF	Engineering Foundation	1914	*	*	2
ECPD	Engineers' Council for Professional Development	1932	10 groups	*	3
EJC	Engineers Joint Council	1945	11 groups	*	1§

* No direct membership and no group quota.
† MECNY did not have an assigned quota but contributed about $2,500.
‡ AIME has 13 at its Societies of Petroleum Engineers Office in Dallas, Tex.
§ These have additional part-time employees.

PRINCIPAL ORGANIZATIONS on construction of UEC

Architects	Shreve, Lamb & Harmon Associates
Structural engineers	Seelye, Stevenson, Value & Knecht
Mechanical engineers	Jaros, Baum & Bolles
General contractor	Turner Construction Co.
Foundations	Thomas Crimmins Contracting Co.
Structural steel	Dreier Structural Steel Co.
Limestone	Monahan McCann Stone Co.
Marble	Aetna Marble Co.
Granite	Jos. Weiss & Sons, Inc.
HVAC	Kerby-Saunders, Inc.
Plumbing	John Weil Plumbing Corp.
Elevators	Westinghouse Electric Corp.
Metal partitions	E. F. Hauserman Co.
Glass and glazing	Pittsburgh Plate Glass Co.
Plaster	E. B. Carley & Co., Inc.
Acoustic tile	Waldvogel Brothers
Window-washing equipment	Spider Staging Co.

Services set up for UEC

Cleaning and general	Allied Maintenance Corp.
Mechanical and electrical	Mance Associates
Food services	Schrafft's Inc.

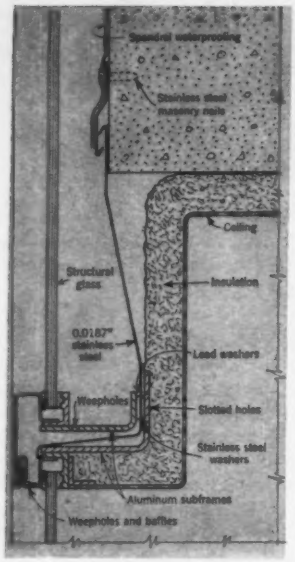


FIG. 3. Longitudinal cross-section through holding devices for glass facade. Washington Steel Corp. furnished the frames.

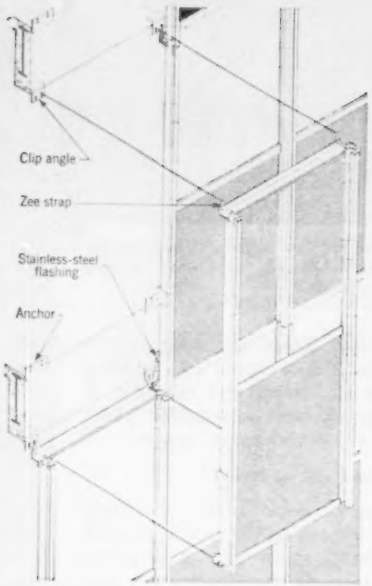
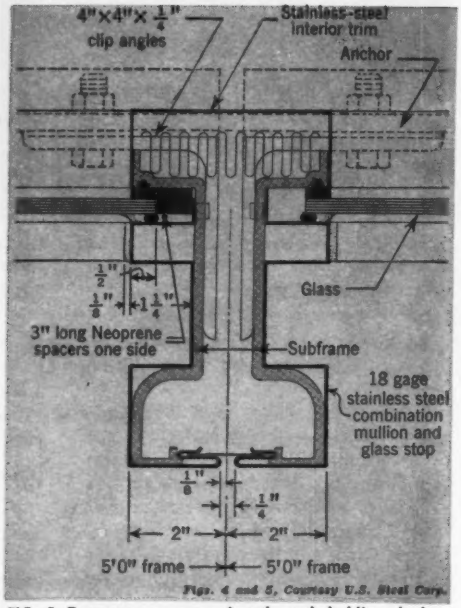


FIG. 4. Isometric shows method used to place glass facing for building.



Figs. 4 and 5, Courtesy U.S. Steel Corp.

FIG. 5. Transverse cross-section through holding devices for windows and glass facing panels.

The UET contracted with Shreve, Lamb and Harmon Associates for the architectural and engineering services for the United Engineering Center. The architects arranged with Seelye, Stevenson, Value & Knecht for the structural design and with Jaros, Baum & Boles for the mechanical and electrical work.

Building of the United Engineering Center was entrusted by the UET to the Turner Construction Company, which handled the work under a negotiated guaranteed maximum cost-plus-fee arrangement.

Civil engineering features

There is civil engineering interest in the United Engineering Center from foundation to roof and from start to finish of the project. Perhaps it has a special interest because it is a somewhat typical building of its class. It is moderate in size, has simple foundations and a frame of economically conventional welded steel. It is the type of structure that engineers have an occasional opportunity to plan rather than a once-in-a-lifetime job. And there are innovations that can be used anywhere.

All-welded framing

Simple but heavy all-welded framing, with a cantilever to avoid columns on the United Nations side of the building in executive suites, is the basic structural feature of the building. Air ducts are framed through webs of the beams to permit a 9-ft floor-to-ceiling height and a story height of 12 ft 6 in. Unusual trusses are provided to carry a future 12-story addition over the main meeting room.

Foundations are separate column footings on Manhattan schist. In most areas the rock has a bearing value of 20 tons per sq ft but a few footings on poor rock are designed for 8 tons per sq ft. The tower section, 69 x 139 ft, is framed with only one row of interior columns and with the exterior columns set partly outside the building. This provides a pleasing exterior treatment and a practically unobstructed interior. The tower section is designed for a live load on each floor of 100 psf, which includes 20 psf for partitions, and a dead load of 73 psf.

The 11-ft cantilever on the east side of the building necessitated the use of cover-plated columns. The heaviest of these is a 14 WF 426 with 3¾ x 14-in. plates on each side for a total weight of 783 lb per ft. (See article by Samuel C. Bast, F. ASCE, CIVIL ENGINEERING, July 1960, p. 62.) After a comparative study of riveting, high-strength bolting and welding, the latter was found more adaptable for wind bracing in a compactly designed building. The floor beams and secondary members are designed as simple spans, held by ordinary bolts. Putting the air ducts through the webs of the girders required substantial reinforcement around the openings and considerably increased the amount of welding.

Three trusses, 10 ft deep, which span 50 ft over the Library Reading Room, now carry only a ceiling and roof load; they will eventually support columns with a 460-ton load at their centers for the planned extension of the lower building block to a height of 12 stories.

Steel erection

Steel fabrication and erection was done by Dreier Structural Steel Co., Inc., which has a fabricating plant in Long Island City. An unusual amount of shop work was required to fabricate the heavy trusses and provide for framing the air ducts through the girders.

Steel for the lower floors was placed by an 85-ton crawler crane. In the tower section the steel was set by a six-man crew using a guyed erectors' derrick with a 90-ft boom and 100-ft mast. From the fabricating plant a truck hauled the steel for two stories in one load. Since there was little space for ground storage, steel was immediately lifted to the height where work was in progress. Milled-end columns, in two-story heights, were set around the periphery and along the center of the tower. The columns were held temporarily by bolts while the horizontal members were set. Two men bolting up, followed by three plumbing steel and five welders, were able to meet the erection schedule of two floors a week. The total weight of steel is about 3,400 tons.

A conventional two-shaft builder's hoist was set up outside the structure to handle concrete, plaster and similar

materials. The first floor of the structure is conventional poured stone concrete. Floors in the tower section utilize lightweight aggregate, which also encases the horizontal steel. Wood forms, hung from the steel, held the concrete. Forms were handed up from floor to floor. Columns generally were fireproofed by solid cinder blocks; on the outside columns 2 in. of concrete was used; for a few columns where space is especially important, thin vermiculite plaster over metal lath was used.

The exterior sheath

A most interesting feature of the United Engineering Center is the exterior sheath of the building and the way it is attached. Vertically, a 6-ft height of plate glass ¼ in. thick alternates with a 6-ft height of light-blue Spandrelite (a ceramic structural glass about ⅜ in. thick). Four windows 5 ft wide fill the space between columns at a spacing of 22 ft on centers.

Stainless steel (No. 4 polished finish except column covers, which are dull 2 D finish) is used for window frames, between the glass and Spandrelite, and for the column covers. Gages range from 14 for the column covering down to 26 for flashing in a protected position back of the Spandrelite. The wall material is in 5 x 12-ft panels assembled at the building before installation. It was only necessary to attach the panel with special straps and stainless-steel bolts and then slip a spline into the joints between sections. This could be done quite rapidly. The windows do not open anywhere in the building. During construction, panes of glass were omitted to permit access at the hoist towers.

Window-washing equipment

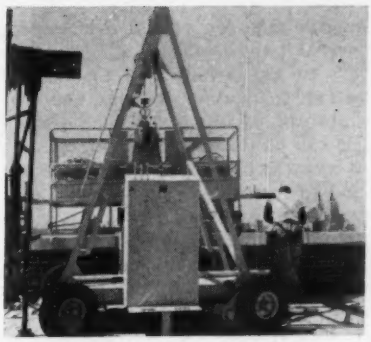
Window washing has gone mechanical. Since windows are not movable and there are no ledges, all exterior cleaning and maintenance for the tower section is done from a scaffold hung from the roof. A steerable rubber-tired carriage moves around the periphery of the roof to support a scaffold that covers two windows—a 10-ft width—and is lowered on cables to allow maintenance men to work. The rig is guided and held at the building by a device that clamps around the projecting mullion between the windows. Electric-powered winches on the scaffold raise the unit about 18 ft per min. The scaffold is moved to a new location by free travel of the carriage on a paved area on the roof. Electric power for the unit comes from cables to roof outlets.

Interior partitions that are expected to be permanent, such as those around the elevators, washrooms and corridors, are generally cinder block. Partitions in the office areas are at the option (and direct cost) of the individual society. Some have plastered gypsum block; ASCE and most others have movable metal and glass partitions, about 5 ft 6 in. high to leave the area open for better light and ventilation.

The inside of the exterior wall, the walls around washrooms and elevators, and at what are expected to be permanent partitions, are conventional plaster. A scratch and brown coat is applied directly on the masonry, then a white finish coat. Walls are painted as desired by the occupant. Some wall areas have a vinyl covering.

Floors generally are terrazzo in first-floor public areas with vinyl asbestos tile in offices. Washrooms have ceramic tile and kitchen areas have quarry-tile flooring. A few suites have carpeting.

The ceiling installed in the office areas of the United Engineering Center consists of an exposed grid suspended from 1½-in. carrying channels. The grid system supports acoustic tile of varying size in addition to fluorescent lighting fixtures. A feature of this system, as indicated in the accompanying photo, permits access into the furred ceiling space at any point in the room. Grid members are galvanized steel. The acoustic tile is constellation-pattern, mineral-fiber ceiling board. In the main meeting room good acoustical properties are attained by a serrated hung ceiling. The face toward the platform is hard plaster. The other face is 12 x 12-in. fissured mineral tile for sound absorption, attached to plaster with an adhesive. Fissured mineral tile is also used in the Exhibition Hall.



Window washing is done from the top. Rubber-tired carriage carries and lowers scaffold for full 20-story height.

Air conditioning

A striking feature of the building's mechanical system is its integrated ventilation control system. The main-

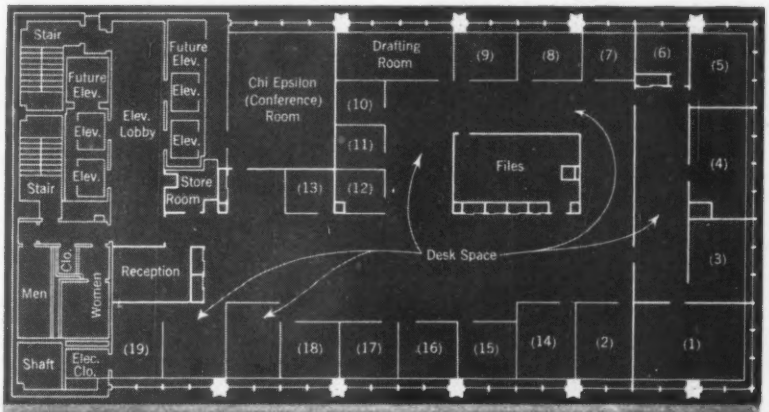


FIG. 6. Layout of the 18th floor—the Executive Floor of ASCE. Partitions shown heavy are full ceiling height; others are metal and opaque glass to height of 5 ft 6 in. The open central area has desk space for secretaries and editorial assistants. Occupants of numbered offices are:

(1) **William H. Wisely, *Exec. Secretary***
(2) **M. O. Chenoweth, *Public Relations***
(3) **E. S. Kirkpatrick, *Exec. Assistant***
(4) **Don P. Reynolds, *Asst. Secretary***
(5) **Don D. King, *Asst. to the Secretary***
(6) **Guest Office**
(7) **Research Manager**
(8) **John H. Fisk, *Asst. to the Secretary***
(9) **Otis D. Gouty, *Asst. to the Secretary***
(10) **Dick Di Maggio, *Art, Production, Civ. Eng.***
(11) **Mary E. Jessup, *News Ed., Civ. Eng.***
(12) **Ruth Campbell, *Assoc. Ed., Civ. Eng.***
(13) **Editorial Reference Library**
(14) **Hal W. Hunt, *Editor, Civil Eng.***
(15) **F. J. Schneller, Jr., *Assoc. Ed., Civ. Eng.***
(16) **Irvin Schwartz, *Asst. Ed., Tech. Publs.***
(17) **Marvin Schechter, *Assoc. Ed., Tech. Publs.***
(18) **Paul Parisi, *Editor, Tech. Publs.***
(19) **Harold T. Larsen, *Manager, Tech. Publs.***

tenance man can sit at a data center, located in the basement, and graphically view the operation of the heating and air-conditioning systems, and control them, in any part of the building. He can project color-graphic slides on a view screen to note temperatures and to reset equipment. Stop buttons with pilot running lights are provided for each fan. More efficient operation results from this automatic control of mechanical equipment, fans, pumps and air-conditioning equipment.

Two systems will heat and cool all space in the United Engineering Center. Air-conditioning equipment for the office tower, together with a water-chilling plant serving all air-conditioning in the building, is located in the mechanical rooms above the top office floor. Another mechanical equipment room, at cellar level, contains apparatus for the conditioning of the public spaces (the Enginering Societies Library, meeting rooms, dining spaces and the Exhibition Hall).

The general air-conditioning of the interior of the structure comes from an overhead duct system. The system serving the public areas is divided so that any of these spaces can be supplied with conditioned air without requiring other spaces to be heated or cooled.

Precise temperature control

The exterior offices make the first use in a large building of the By-pass Weather-master units made by the Carrier Corporation. About 370 of these are installed under windows. The self-contained unit permits precise control of room temperature by the occupant.

Water, heated in winter and cooled in summer, is passed through the units constantly. Instead of varying the water flow through the coil, as in past practice, dampers regulate the amount of room air that flows through the coil. A bypass arrangement allows the air to flow through the coil or deflects it around the coil.

In operation, conditioned primary air enters the base unit at high pressure. From there it flows quietly through plastic injector nozzles at high velocity. The resulting air stream induces room air over the unit coils, where it is either heated or cooled depending upon the water temperature in the coil.

Steam from the Consolidated Edison system is used to heat the building and to furnish energy for operation of the water chilling machines. One centrifugal and one absorption unit are arranged to utilize steam twice —first to drive the turbine compressor of the centrifugal machine, and then to supply the heat necessary for the operation of the absorption machine.

Water is provided to the building in two zones. Areas on the lower floor are supplied with water at street pressure. Meters and hot-water heating equipment for this system are located in the basement. The tower floors are supplied from two storage tanks located in the penthouse machine-room. Hot-water heaters and circulating pumps are also located in this room. Where excessive pressures are developed by the height of the tank above fixtures in the lower tower floors, pressure-reducing valves are used.

Each hot-water heating plant includes a water preheater designed to reclaim the maximum heat possible from the waste condensate from the heating and air-conditioning systems before it is wasted to the sewer.

Electrical facilities

Electrical service for the United Engineering Center is provided from the Consolidated Edison system at 265 or 460 volts through a single service takeoff. Office lighting is fluorescent, placed modularly to maintain an average of 75 ft-candles in open areas. An exception to this is the Illuminating Engineering Society space, where facilities for 200 ft-candles have been installed. All fluorescent lighting in office areas is operated at 265 v. Incandescent lighting and receptacle plugs in office areas are at 120 v from dry-type transformers. A double underfloor duct system for electricity and telephone lines is provided in all office space to permit maximum flexibility in the rearrangement of these areas.

Automated elevators

Four highly automated elevators supplied by the Westinghouse Electric Corporation service the United Engineering Center. Three passenger elevators and one service car, which is available for passenger duty during peak traffic hours, will operate from the basement to the top floor of the 18-story building. Equipped with a gearless drive, these cars each have a capacity of 3,000 lb or 20 persons, and travel at a maximum speed of 700 fpm. Provision has been made for the addition of two passenger elevators in the future. A smaller elevator services five floors in the library book stacks. This geared unit has a capacity of 1,200 lb and travels at 75 fpm.

The passenger cars are electronically directed by Westinghouse controls, which include the Selectomatic system enabling a bank of elevators to work together to provide equal service to all floors. An Automatic Traffic Pattern control automatically adjusts elevator operation to passenger demand depending on the conditions, day or night.

Operation and maintenance

The United Engineering Trustees will manage, operate and maintain the new building. The operational housekeeping at UEC has been contracted to Allied Maintenance Corp. They supply and supervise cleaning, elevator operation and custodial personnel. Mance Associates will maintain and operate mechanical, electrical and air-conditioning facilities and are responsible for preventive maintenance in the structure.

Food services are supplied by Schraffts, Inc., using facilities made available to them. Prices in the cafeteria are expected to be about 60 percent of that in their public restaurants, with service limited to employees in the building.

New, spic and span

Everything is new on the ASCE floors of the United Engineering Center. All the old desks, chairs, filing cabinets and fans were sold for salvage and left behind along with much of the accumulation of 44 years at one address. Many favorite pictures and maps were sacrified to a clean, uncluttered decor.

The new furniture and furnishings are modern but not modernistic. Plastics and metals are used extensively in open areas, where pleasing variation in color is obtained with putty colored walls, dark desks with light plastic tops and colored fabrics on chairs. Decorative woods appear in desks and credenzas in private offices, with special wallpaper in some areas.

Chi Epsilon, honor civil engineering fraternity, raised $10,000 to furnish the ASCE conference room as its contribution to the UEC. A large walnut table surrounded by arm chairs upholstered in light-green leather is effectively set off by a chartreuse wall covering and wall-to-wall carpeting.

The view from all sides of the building is superb. On the southeast the executive offices overlook the United Nations buildings, Plaza, and the East River. To the northeast is exclusive Sutton Place and the Queensboro Bridge. To the northwest and southwest, Manhattan's tallest structures are widely spaced along the city's fabled skyline. Across the street to the south is the Carnegie Foundation for International Peace, a symbol, with the UN, of the world the engineers are trying to relieve of drudgery by adapting the forces of nature to the needs of man.

Public relations —organizing an effective program

WESLEY H. BUTLER, F. ASCE, President, Alaska Section, ASCE

Just as the engineer has his tools, so anyone engaged in public relations has his. First and foremost of these tools is publicity—what many people think about when public relations is mentioned. Among the more important media through which publicity functions are newspapers and other publications, radio and television, exhibits, and public speaking. The techniques of using publicity are well outlined in ASCE's *Local Section Handbook* and *Public Relations Guide*.

Do a few things well

The criterion of doing a few things well is particularly true of publicity. Getting your Section and the names of members in the limelight as often as possible without regard for the appropriateness of the material or the occasion is dangerous in the extreme. Good taste and restraint are the watchwords for sound publicity that will enhance the status of the profession.

Just a word about exhibits. They are valuable publicity tools. Through them the details of the engineer's work can be shown. By using drawings and photographs it is possible to give the public a glance behind the scenes and show the important role the engineer plays in the community and the world. Displays and exhibits need not be elaborate, multicolored or extremely artistic to be effective. The proper use of just a few photographs on a piece of cardboard can tell the story of a bridge project, for example.

Exhibits can be used almost anywhere and any time. Every community has a number of special events during the year. With a little imagination and planning, an exhibit that will tie engineering activities to the event can be prepared to tell the story in an effective way. There is another very important result of making a special effort to have exhibits at community events, that is, the public is made aware that here is an organization interested in community affairs. This psychological effect can be very great. It is valuable in establishing prestige.

Public speaking can be an important tool in promoting good community relations; when ably done, it is a means par excellence of winning friends and influencing people. The opportunities to address civic groups, chambers of commerce, luncheon clubs, school audiences and other community gatherings are almost unlimited. The Section's public relations representative should keep a card file that gives the qualifications of each member of his speakers' bureau. This way, he will be able to provide the right speaker for the right place. When warranted and possible, the press should be furnished advance copies of an address. Many times newspapers will print a speech verbatim thus giving wide distribution to valuable publicity.

Another useful tool in community public relations is community service. Every segment of the community can benefit from the advice and experience of an engineer whether he be assisting in a technical problem or leading a youth group. Individual Section members should be encouraged to accept assignments in community and civil activities. Parts of the Section or even the Section as a whole can be brought in to accomplish some community job.

One caution regarding community service—it must be just that—service. Any attempt to play up such service will almost invariably result in a negative reaction on the part of the public. If the project or service is worth while, you need not worry about the publicity. Somebody else, usually the recipient, will provide all you need.

Developing a program

How should an effective relations program be developed?

1. The first step is to determine the objectives. They are substantially these:

- To gain and hold public friendship and respect
- To further policies and practices that coincide with the public interest
- To inform the public of the true story of the profession, its essential and ethical service to humanity
- To encourage respect for laws and regulations affecting engineers and the practice of engineering
- To defend the profession from unjust attack
- To keep its members informed on matters of interest
- To maintain a high morale among the members of the profession.

2. The second step is to define the problem. Is the need for internal or for external public relations? Undoubtedly it will be for both. The relative amount of emphasis to be placed on each will vary from time to time. However, one point is very important: public relations begin at home. Your internal public relations must be excellent or any program you set up for external public relations will not have the backing of your members and will fail miserably.

3. The third step is to determine how the needs are to be met. Here is where you decide what things are the most important. In making this selection, it is not enough to be abreast of the times; you must be in the vanguard, helping to shape the pattern and leading others who are affected by it. The "personality" of the community and the relationship of your Section to it will dictate what is to be done.

4. The fourth and last step is to pick your tools. Your decision here will determine how well your aims will be accomplished. Again, refer to the *Local Section Handbook* and the *Public Relations Guide* on how to use your tools.

By making yourself familiar with the foundations of public relations, following a few simple rules, seeking the assistance of others in the public relations field, and using good common sense, you can develop and administer a public relations program that will be of great value to your Section, your community and your profession.

(This article is taken from Mr. Butler's address before the spring Local Section Conference in Spokane, Wash.)

Fifteen giant trusses resting on thirty 70-ft columns will support the three-story addition on top of the existing Port Authority Bus Terminal in New York, N. Y.

BUS TERMINAL EXTENDED

Three new parking levels over the Port Authority Bus Terminal in New York are carried by giant prestressed steel trusses supported by steel columns 70 ft high placed outside the existing structure. Parking space for over 1,000 cars will be provided in the three-level addition, part of a $20,250,000 expansion program that will increase the Terminal's capacity by 50 percent.

The existing building has five levels including the roof. There are two levels for bus traffic below the roof, the lower for long-distance buses and the upper for suburban commuter buses. In addition, there is a Main Concourse on the street level and a Suburban Concourse on the second level. These levels also have ticket windows, waiting rooms, baggage rooms, restaurants, shops and other services. The roof level, which has parking capacity for over 450 passenger cars, can be reached by ramps directly from the Lincoln Tunnel or city streets. The expansion project calls for the conversion of the existing roof to bus operations. To handle the added capacity, the direct-ramp system between the Terminal and the Lincoln Tunnel is being expanded.

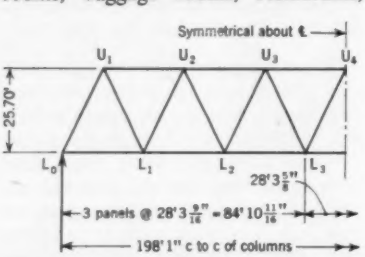


FIG. 1. A Warren truss was selected for the three-story addition to the Port of New York Authority Bus Terminal because of its diagonal arrangement, which provides openings for vehicular ramps and aisles.

The existing building, which is 200 ft wide, was so designed that all steel sections were utilized to their maximum strength. Therefore the additional stories could not be carried on the original structure. To support the addition, the engineers elected to use fifteen prestressed steel trusses three stories high. These trusses are 200 ft long, spaced 50 ft on centers, and carried by thirty new columns and footings outside the existing wall. The 70-ft-high columns weigh 22 tons each. The intermediate level is supported by hangers framed in at the panel points of the upper chord.

Columns

Fifteen massive columns were placed at 50-ft intervals against the existing walls of the terminal on 40th and 41st streets. Lifted by truck crane, the columns were put in place and secured by anchor bolts at the base; new footings and piers were poured—designed to act compositely with the existing foundation. Connections were made to girders on each floor of the present terminal. Eventually the columns will be encased in white concrete.

The south end of each truss is supported by a link 11 ft high. At the top and bottom of the link there is a pin of 12-in. diameter. The lower pin is connected to the column. A knee-brace is fastened to the center of the link and to the bottom chord of the truss. Horizontal movement is thus controlled. The north end of the truss bears on a similar link except that the brace is omitted.

These permanent knee-braces at the south end will not be installed until the parking decks are completed. To prevent movement during erection, a temporary brace is fastened to the south link and tied to the existing roof girders. This temporary brace will not be removed until the permanent brace is installed.

The three-story addition acts as an independent structure since there is no physical connection between it and the existing building except for the new columns, which are tied to the existing columns for lateral support.

Expansion is provided for every 200 ft. At these locations the 50-ft girders framing into one side of the truss are made to rest on sliding bearings to permit movement.

UPWARD THREE STORIES

Prestressed steel trusses of 200-ft span carried on steel columns 70 ft high

MAURO A. CETRA, M. ASCE, Regional Engineer, American Institute of Steel Construction, New York, N. Y.

A Warren truss (Fig. 1) was elected because of its characteristic diagonal arrangement, which provides openings for ramps and aisles for vehicles. The trusses are diagonally braced in the plane of the top chord and at the portal in alternate bays.

At the preliminary stage of design, prestressing of the lower chord was not considered. As in all truss design, the weight of the steel and the concrete encasement was assumed, and the dead and live loads of the floor system were determined. Stresses for the various loading conditions are shown in Table I.

As can be seen, the maximum tensile stress in the lower chord is 5,412 kips. A box section using A242 steel (high-strength, low-alloy) became very deep and required heavy plates. Keeping the depth to a minimum was important in order to hold down ramp grades in the building.

It was found that prestressing of the lower chord would provide a shallower chord besides yielding a substantial reduction in cost (about $200,000). A minimum section was determined, as shown in Fig. 2.

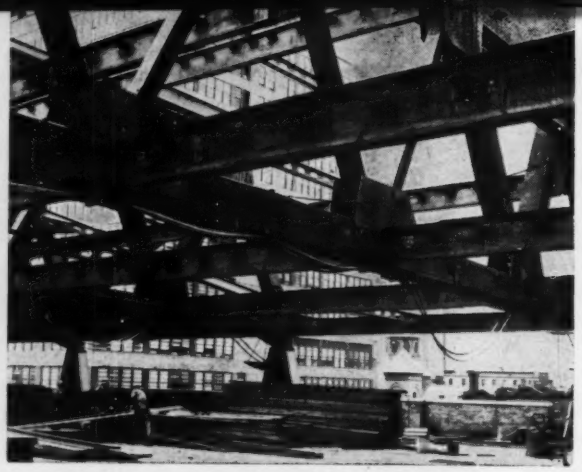
The design for the prestressed lower chord employs eight strands between

TABLE I. Typical truss analysis, conventional, with no prestressing (loads in kips)

Member	Dead-Load Stresses				Max L.L. Stress		Full $\frac{L.L.}{2}$ Stress	
	Steel	Concr.	Wearing surface	Total D.L.	L.L.	D.L. + L.L.	$\frac{L.L.}{2}$	D.L. + $\frac{L.L.}{2}$
L_0L_1	+188	+725	+75	+988	+444	+1432	+222	+1210
L_1L_2	+479	+1795	+197	+2471	+1176	+3647	+588	+3059
L_2L_3	+651	+2436	+270	+3357	+1616	+4973	+808	+4165
L_3L_4	+706	+2650	+294	+3650	+1762	+5412	+881	+4531
U_0U_1	−345	−1295	−139	−1779	−832	−2611	−416	−2195
U_1U_2	−577	−2151	−237	−2965	−1418	−4383	−709	−3674
U_2U_3	−688	−2578	−286	−3552	−1712	−5264	−856	−4408
L_0U_0	−390	−1505	−155	−2050	−921	−2971	−460	−2510
U_0L_1	+324	+1181	+135	+1640	+810	+2450	+402	+2042
L_1U_1	−279	−1038	−119	−1436	−733	−2169	−355	−1791
U_1L_2	+204	+735	+84	+1023	+568	+1591	+251	+1274
L_2U_2	−153	−591	−68	−812	−501	−1313	−205	−1017
U_2L_3	+76	+293	+33	+402	+365	+767	+99	+501
L_3U_3	−37	−149	−18	−204	−314	−518	−52	−256
Reaction	342	1319	135	1796	808	2604		

Final section of the last truss is put in place while bus operation continues.

Pin at end of truss can be seen at right. Note also girder at intermediate level supported by hanger from top chord.



Prestressing cables hang loosely in place before jacking. Prestressing provides a shallower chord and a substantial reduction in cost.

L_2 and L_3, and four between L_5 and L_6 and between L_6 and L_7. Strands are 2 1/16 in. in diameter.

The design was based on the following sequence of loading: (1) dead load of structural steel; (2) prestressing of bridge strands; (3) dead load of concrete applied with bridge strands stressed but unbonded; and (4) live load plus wearing surface applied with the bridge strands stressed and bonded to the chord.

Bending of the lower chord was determined for uniform load, secondary moments, and the effect of camber. Effect of uniform load on bending needs no further explanation. The secondary moments result from the deflection of the truss and the rigidity of the joints. The deflections were obtained from a Williot diagram. The fixed-end moments due to these deflections were distributed by using the Hardy Cross method of moment distribution.

The Port Authority's computer program for the solution of moment distribution in rigid frames is readily adaptable to this problem. Therefore the secondary moments were obtained on an IBM 650 digital computer.

Bending moment due to camber can be divided into two parts—effect of stress in the chord and effect of stress in the cable.

For member L_0-L_1, the chord stress is (5,412 − 240 x 8 − 451), or 3,041 kips, and the maximum chord camber is ¾ in.

Moment due to chord stress, assuming hinged ends, is:

$$M = 3{,}041 \times 0.0625 = -190 \text{ kip-ft.}$$

Moment due to cable stress, assuming continuity, is:

$$M = 2{,}371 \times \frac{0.0625}{2} = \pm 74.2 \text{ kip-ft.}$$

Bending moment diagrams for uniform load, secondary moment and effect of camber are given in Fig. 3.

The summation of primary moments gives a maximum bending

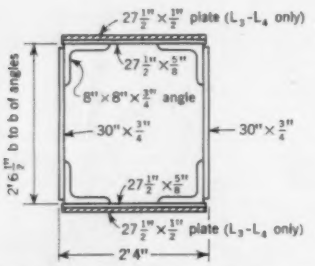


FIG. 2. Prestressing lower chord of truss reduces the chord depth and yields a substantial saving in cost.

TABLE II. Final stresses in lower chord of truss and in prestressing cables (kips)

	Lower Chord				Prestressing Cables			
	L_0-L_1	L_1-L_2	L_2-L_3	L_3-L_4	L_0-L_1	L_1-L_2	L_2-L_3	L_3-L_4
Dead load, steel truss girders & bracing	+188	+479	+451	+706	.....	.....	.....	.....
Prestressing of lower chord	−960	−960	−1920	−1920	+960	+960	+1920	+1920
Dead load, concrete encasement & deck units	+605	+1675	+2196	+2410	+120	+120	+240	+240
Dead load, wearing surface	+70	+186	+238	+263	+5	+11	+32	+31
Total dead load including prestress	−97	+1380	+965	+1459	+1085	+1091	+2192	+2191
Half live load	+208	+552	+711	+791	+14	+36	+97	+90
Dead load + prestress + ½ live load	+111	+1932	+1676	+2250	+1099	+1127	+2289	+2281
Dead load + prestress + live load	+319	+2484	+2387	+3041	+1113	+1163	+2386	+2371

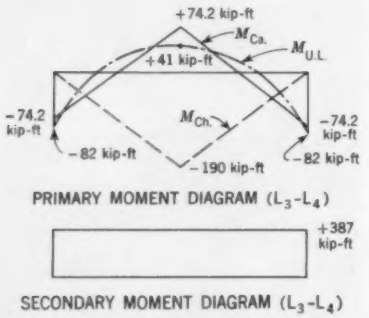


FIG. 3. Primary bending moment diagrams show moments for uniform load (U. L.). Bending moment due to camber has been divided into two parts—effect of stress in the chord (Ch.) and effect of stress on the cable (Ca.) Lower figure is secondary moment design.

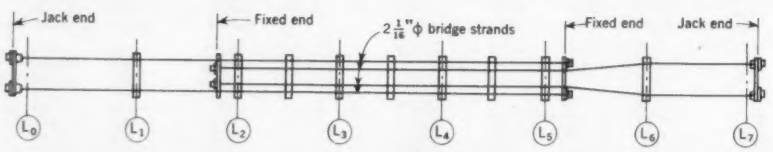


FIG. 4. Schematic diagram gives plan of bridge-strand arrangement for prestressing the lower chord of the truss.

Steel stands, $2\frac{1}{16}$ in. ▶ in diameter were used to prestress the lower chord of the three-story-high trusses. The saddle at the fixed end (typical at joint L_2 and L_3) can be seen.

◀ Jack and jacking rig have been set up at exterior column.

moment of -156.2 kip-ft at the panel points and -74.8 kip-ft at the center of the chord L_3-L_4.

The effect of maximum secondary moment was less than 3,000 psi and therefore was treated as a secondary stress (according to AASHO). A tabulation of the final stresses in the lower chord, together with the cable stresses, is given in Table II.

A schematic diagram of the bridge strand arrangement in the lower chord and details of the strand saddles used for support are shown in Figs. 4 and 5.

Cable jacking

Careful instructions for cable jacking were given. To take readings measuring pressure and elongation:

1. Prejack the cable to a 20-kip tension to eliminate all sag and use this as the zero reading.
2. Take a reading of the jack pressure and of the elongation at each 55-kip increase in jacking to the final load of 240 kips (20 kips, 75 kips, 130 kips, 185 kips and 240 kips).
3. When a difference of as much as 5 percent is found between the jack-pressure reading and the force causing elongation as ascertained from the elongation reading, jacking should be stopped and the reason for this difference ascertained before proceeding.

The design for this project was originated and carried to completion by the Engineering Department of the New York Port Authority. The chief engineer is John Kyle, Jr., F. ASCE; the structural engineer, Arne Lier, F. ASCE; the engineer of design, Joseph Fabian; and the architect, Michael DiNunzio.

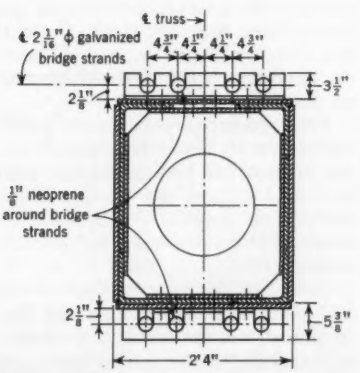


FIG. 5. Typical cross section through bottom chord of girder at a cable support.

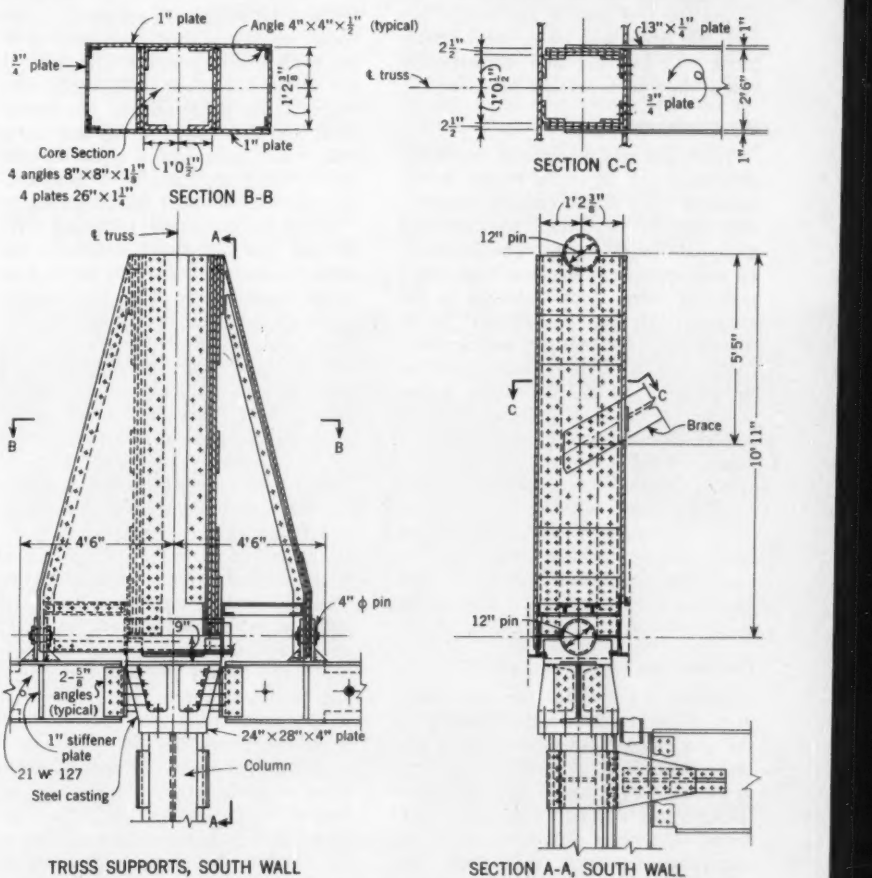


FIG. 6. A link connects one end of the truss to the column. A knee-brace from the center of the link to the bottom chord of the truss at the south end controls horizontal movement.

Bridge foundation preloaded to eliminate settlement

H. Q. GOLDER, M. ASCE, Partner, H. Q. Golder & Associates, Ltd., Consulting Engineers, Toronto, Canada
A. B. SANDERSON, Partner, A. B. Sanderson & Company Ltd., Consulting Engineers, Victoria, B.C.

A steel arch bridge to carry the Trans-Canada Highway across the Fraser River in British Columbia presented serious foundation problems to the consulting engineers. Founded on a considerable thickness of sand and gravel overlying bedrock, the 805-ft bridge involved conditions compatible only with abutments on rock. The problem was purely one of settlement.

Preloading was the solution. By applying the full load of the bridge before the arch was built, total settlement was induced and construction could start in a normal manner.

Site requirements

There are very few places where the new road can cross the Fraser River. Some of these would require considerable lengths of tunnel to meet the alignment requirements. The site chosen was apparently the best from every point of view. Rock outcrops in the banks of the river just up and downstream from the site, and borings indicated rock at 30 ft on both banks at the positions of the abutments. It was possible to cross the railway lines, of which there is one on each bank, at a suitable level, and no tunnels were involved. Accordingly a fixed steel arch of 805-ft span, with a rise of 115 ft 6 in., was designed—to be founded on rock. Since the alignment requirements are much more stringent than those for the old road, the new bridge is on a skew.

The foundation problem

During excavation for the main-arch abutments it became evident that the original borings were in error and that a layer of large boulders had been mistaken for bedrock. No rock was found at the designed depth, and diamond drill holes put down from the excavations showed that rock was over 200 ft from the proposed founding level on the west side of the river and about 150 ft on the east side. This posed a considerable problem, for not only had a certain amount of money already been spent on this site, but it was also by far the best from every point of view except that of foundation conditions. It was therefore necessary to find a solution to the foundation problem at this site if at all possible.

The river at the site of the bridge is fast and turbulent and subject to large floods, so that it should be crossed in one span if at all possible. The sides of the gorge are steep and rocky. At the site, the gorge widens out somewhat and the lower levels are filled with what looks like a river terrace, but in which the material is completely unsorted—or only partly sorted.

From the abutment founding level to rock, the soil profile shows an unsorted sediment to a depth of 30 ft at which depth a layer of boulders occurs in which the voids are apparently unfilled and in which washwater and drilling mud were lost. Below this come more sand and gravel down to about 100 ft. Here there is a layer of clay, which appeared from inspection of the samples to be soft. However these samples were probably disturbed and the clay in its natural state must be stronger than it appears since it has had a load of more than 3 tons per sq ft on it for several thousand years. The clay layer is important but fortunately it is at most a few feet thick, and later some doubt arose as to its continuity. Below the clay come sand and gravel to bedrock.

The problem as first stated was to design a foundation for a fixed arch of 805-ft span—with the soil conditions as given above. This meant an applied load of about 8,000 tons, inclined at a little more than 20 deg to the vertical. No settlement could be accepted, and a rotation of the skewback to the arch of more than 0.2 in. on a length of 20 ft would release the fixing moment. Further, live loads on the bridge would cause a movement of the line of thrust about its dead-load position with variations in direction, and no movement of the foundation must follow these variations.

Two-hinged arch in place of fixed arch

These conditions are clearly compatible only with abutments on rock. No one could guarantee stability under variable loads on sand and gravel. The original design was therefore altered to a two-hinged arch. It is worth noting that the original design was programmed for the Alwac III E computer at the University of British Columbia. Possibly for the first time the stresses were known throughout the length of the fixed arch. The program was altered to relate to a two-hinged arch and put through the machine again. The resulting design used about 10 percent more steel than the fixed arch, as would be expected, but the disposition of the steel was of course different.

As a matter of interest it is appropriate here to question whether in fact the necessary fixing moment is ever achieved in a fixed arch on rock, or whether temperature movements are not sufficient to relieve these moments. For the two-hinged arch settlements are important but there is no question of fixing moments.

The total pressure on the soil under the abutments would be about 5 tons per sq ft, and in view of the frictional nature of the soil and the size of the footing, no question of shear failure arose. Settlement was the primary concern.

In soil of this type, settlement will take place immediately when the load is applied, and the rebound if the load is removed will be small. Settlement will be partly due to compaction, and partly to an elastic deformation of

General view of site shows construction of new bridge under way in foreground and existing bridge in middle distance.

the soil structure. Settlement can be reduced by compacting the soil first. A frictional soil, when dense and under load, is rigid and has a conservative structure under static loads. Under vibration or alternating loads, however, very small movements may occur. Not much is known about the mechanism of these movements or how long they can continue. It was for this reason that a fixed arch was ruled out.

The problem then was to provide at foundation level a base that would not move either vertically or horizontally when the dead load of the bridge was applied.

Five solutions considered

Five possible solutions were considered:

1. Piers to rock. It would probably be possible to sink large cylinders, say 8 to 10 ft in diameter, down to rock by a combination of pumping, grouting and compressed air. Similar depths were achieved by these methods in the cutoff for the Silent Valley Dam in northern Ireland. The process would undoubtedly be difficult and expensive because of the high head of water, the permeability of the lower materials, and the presence of the large boulders. No serious consideration was given to this solution.

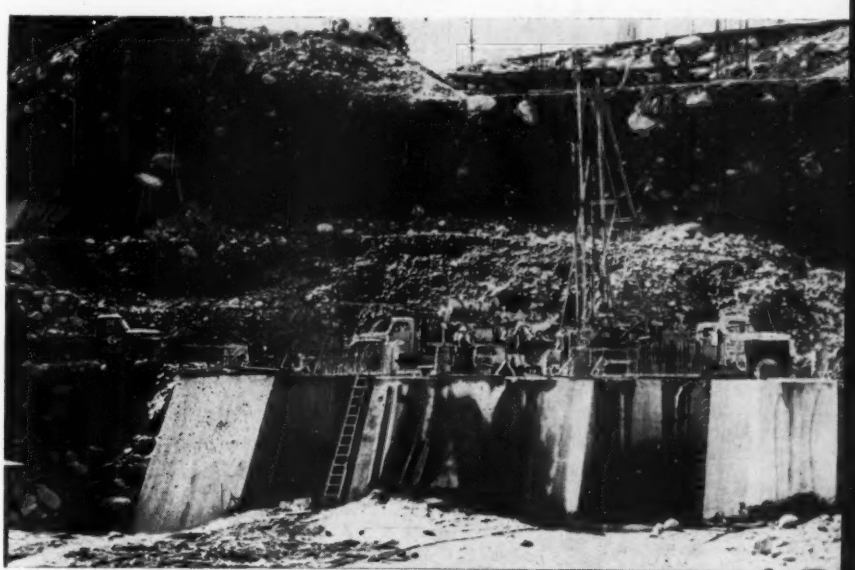
2. Grouting. It was suggested by The Cementation Co. Ltd. that a grouted block might be formed under the footing to spread the load and so reduce settlement. This would be done by washing out the silt from between the sand and gravel particles by pumping in water from closely spaced pipes. The same pipes would then be used to inject grout into the soil.

This method has been used to form temporary cofferdams, notably at Kariba Gorge on the Zambesi in southeastern Africa. However, in the case of a cofferdam the aim is impermeability, and any leaks that appear can be regrouted. In the arch foundation, the aim is rigidity, and any movement will only show up as the load is applied—too late for any remedial measures. There is the further objection that settlement may well occur in soils below the grouted block.

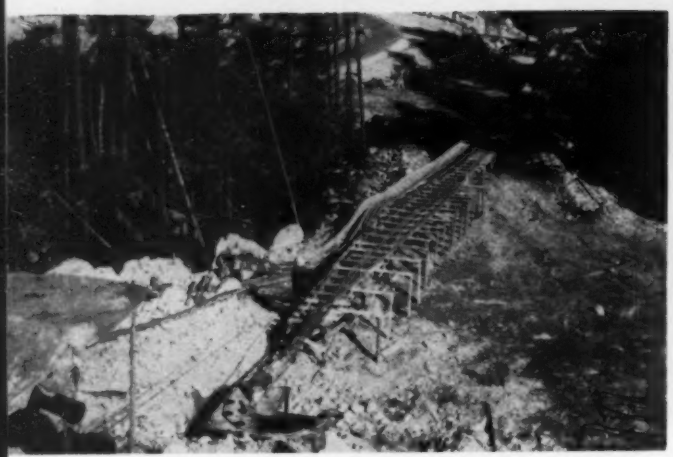
3. Compaction. If the soil could be compacted below the footing and down to rock, the settlements would be negligible. There are three ways to do this: by driving piles; by penetration vibrators, a German process known as Vibroflotation in America; and by vibrations caused by explosive charges.

The boulders in the soil prevent the use of the first two methods in the present case. The use of explosives fired in boreholes is a possibility, but the objection is the uncertainty of the result, and the possibility of damage to existing railways and hill slopes above the site.

4. A floating foundation. On the west bank some 70 ft of soil had been removed from above the level of the foundation for the arch abutment. It is possible to go down still deeper to water level, at which level the soil has been subjected to a pressure of over 5 tons per sq ft by its overburden. If a hollow foundation were built at this level, the total load applied could well be less than the weight of soil removed. The settlement would then be limited to the recovery of any rebound that might occur as the soil was excavated. This would be small. Lateral movement might occur under horizontal forces, but it is theoretically pos-



Holes, 6 to 8 in. in diameter, were drilled through the overburden and a casing was set into the rock. A hole, 4½ in. in diameter, was then drilled into the rock until a 40-ft depth of sound rock was found.



Twelve cables, made at site, were used in each of the two abutments. Each cable contains 130 double wires of 0.20-in. diameter.

Jacks and packing blocks are seen in place as cable stressing continues. Each double cable was stressed to a load of 667 kips.

sible to reduce this movement by building the hollow foundation in two parts with a vertical joint, and then jacking the footing laterally against the soil behind it, thus taking up the movement before the bridge is built.

This solution is theoretically a possibility. The objections are the difficulty of excavating through the boulders and supporting the hillside, the unknown but small vertical movements, and the complications of the horizontal jacking arrangements. These latter might have been eliminated by redesigning the bridge as a truss with vertical reactions. Construction difficulties ruled out this method.

5. Preloading the soil down to rock. The full load of the bridge could be applied to the soil before the arch was built. Any settlement would take place then and would be of no consequence.

This solution was adopted. Its effectiveness depends, it was realized, on the fact that, with the exception of the thin clay layer at a depth of 100 ft, all the soil below the foundation is such that any settlement will take place immediately on application of load, and any recovery on release of load will be small. Some settlement may occur in the clay layer, but this will not be great because of its thinness and great depth. Also, the settlement would rapidly come to a stop in such a thin layer with drainage layers above and below.

A two-hinged arch having been decided on, a heavy abutment was designed. This was to be tied to the rock below by cables of high tensile steel placed in bored holes through the overburden and down into the rock and grouted in. By means of jacks the cables were then to be stressed to a vertical load equal to that to be applied by the finished bridge, plus live load. The anchored foundation block was then to be used as a reaction, and a load equal to the horizontal thrust from the completed arch was to be applied to the face of the cut behind the block. This was to be done at both abutments. The soil would then be stressed exactly as it would be later by the completed bridge, and any settlements would occur then rather than later. Cyclic release and reapplication of these stresses at this stage would make it possible to determine whether it would be necessary to release the stress gradually as the bridge load was applied or whether the stress could be safely released then.

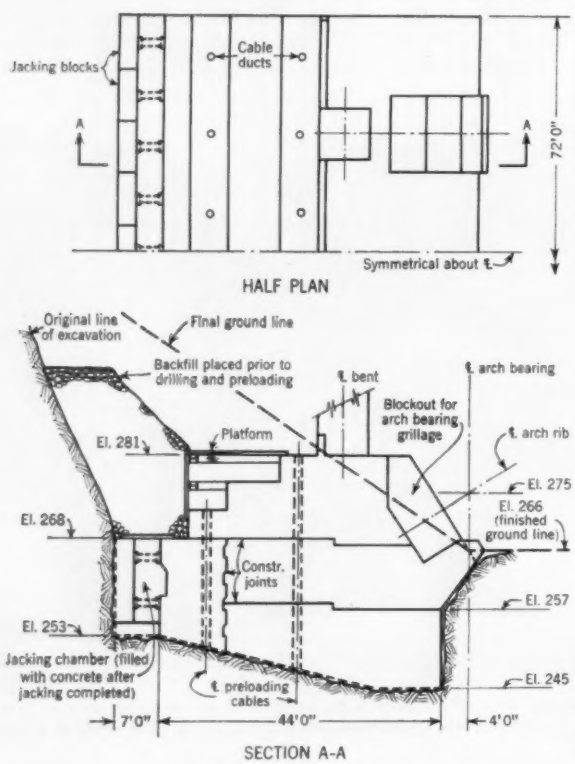


FIG. 1. Plan view and section of heavy abutment show cable layout and provision for horizontal jacking.

Details of the solution

The design of the heavy abutment is shown in Fig. 1, which also shows the cable layout and the provisions for horizontal jacking. The cables were double and in the shape of an inverted U; there were twelve cables at each abutment. Since each double cable was stressed to a load of 667 kips, the total load applied was 4,000 tons.

The horizontal load applied by jacking was 1,800 tons. As the total vertical load on the block at this time was 11,000 tons, that is, the weight of the block plus the load in the cables, the coefficient of friction required under the base was only 0.16.

Each cable consisted of 130 double wires each 0.20 in. in diameter. The yield properties of the steel were specified as an elongation not exceeding 0.1 percent at 80 long tons per sq in., the ultimate tensile strength being 246,000 psi. The working stress was to be 163,000 psi. Galvanized wire was used and since the cables would be needed only temporarily it was not necessary to protect them against corrosion. The drill holes were specified as not less than 4½ in. in diameter, cased to the top of the rock, and the anchor hole in the rock was to be 4½ in. in diameter. It was expected that the anchors would go 40 ft into sound rock.

The horizontal stressing was to be done with 18 jacks each of 100-ton capacity. The load was applied against a wall of concrete previously cast against the excavated face of the hillside behind the abutment block, as shown in Fig. 1.

Drilling difficulties

Considerable difficulty was encountered by the drilling contractor in drilling vertical and straight holes. The main trouble was caused by the boulder layer, in which the churn drills were deflected from the vertical by the boulders. The drilling was extremely slow. When the hole wandered off line the driller pulled his casing, allowed the hole to collapse, and then started again. This led to the formation of voids under the block which later had to be grouted. It was also at least partly responsible for tipping of the west abutment block.

The specification for verticality was relaxed in order to get the holes down. It was realized that in this particular job a truly vertical hole was not necessary as long as the position of the bottom of the hole was known. This must be known in order to avoid two holes being so close together that they stressed the same area of rock. Further straightness, which is normally required to ensure that the cable can be surrounded by grout in order to protect it from corrosion, was here only necessary to enable the cable to be inserted. It would not matter if the cable touched the side of the hole at a point 100 ft or more below the block.

The holes were drilled through the overburden in sizes of from 6 to 8 in. in diameter and a casing was set into the rock. A hole of 4½-in. diameter was then drilled into the rock. On the east side, the holes went about 80 ft into rock and on the west side about 50 ft.

Little difficulty was experienced in making and placing the cables, largely because of careful preparation by the specialist contractor (Cementation Co. Ltd.). Stressing was accomplished without difficulty. A few strands broke in some of the cables, but the required total load was attained.

The horizontal preloading was also carried out without incident. Very careful measurements were taken during the preloading operations to detect movement of the block. These comprised a system of water levels, and observations with transits and optical levels remote from the block. The movements were small in all cases. The maximum settlement observed was 0.04 ft. The movement under the horizontal stress was only 0.007 ft and the recovery when the load was removed was to minus 0.01 ft. This may have been due to prestressing of the ground caused by the tilt.

Because the settlements and recoveries were so small, it was felt safe to release the load in the vertical cables after filling the jacking chamber at the back of the block with concrete. However, it was decided to maintain the vertical load for 12 days, during which time the settlement was less than ⅛ in. Before this decision was taken, the vertical load was temporarily released, with a recovery of $\frac{1}{16}$ in.

The load in the cables was measured in two ways: (1) the jacks were calibrated and the pressure in the jacking fluid was measured, and (2) the extension of the cables was measured and compared with that expected from the stress-strain curve for the steel wire. Fairly good agreement was obtained between these two methods. The horizontal load was measured by the jack pressure only.

It was found that the block on the west side had settled at one corner before preloading commenced. It is thought that this was due to removal of ground from below the block during the drilling operations, and also possibly to compaction caused by blasting boulders in the boulder layer. To fill any voids that might exist below the block, grout was poured down a pipe at the position of each cable. A total of about 23 cu yd of grout was used.

Method evaluated

In view of the small settlements obtained it might be argued that the whole operation was unnecessary. The two-hinged arch bridge could accept movements of about 2 in. vertically and 1 in. horizontally without an undue increase in stress. It is worthwhile therefore to give some consideration to the procedure that we would adopt if faced with the same problem again, and what the solution at this site would have been had the depth to rock been known in advance.

The experience at this site cannot be applied to another site because it would not be safe to assume that the settlements at any other site would be as small as those measured here. The density of sand and gravel deposits can vary widely and settlements greater than the acceptable values might well occur. It would be necessary therefore to assess these settlements in some way, and in soil containing boulders this is not easy. Samples cannot be taken and penetration tests may be impossible. The alternatives are to compact the soil so that the density is known to be high. On some sites this can be done by explosives. A floating foundation that would impose no increase in weight on the soil could be used for a suspension bridge; or, for an arch, horizontal stressing in a split foundation might be employed.

The choice of an arch bridge at this site was originally dictated by the necessity of crossing two railroads. The towers for a suspension bridge would have been inordinately high, and there was not sufficient room to get the anchors in at a suitable level, since the positions of the main towers were more or less fixed by the river, the existing road and the two railroads. A cantilever bridge was not suitable because of the high level required, and a girder bridge was impracticable because of the necessity of crossing the river in a single span to avoid trouble from floods. The arch then was almost the only solution possible. Given an arch bridge at this site, the solution used would have been the only answer, since no one would dare to build an arch merely assuming that the settlements would be negligible.

The unusual foundation conditions added about $620,000 to the estimated cost of the bridge of $4,300,000, or 14 percent. This includes $206,000 for extra steel in the two-hinged design. The preloading itself cost $414,000. A rough estimate shows that the cost of alternative routes, including the necessary tunnels, is at least of the same order, and the present alignment is much superior to any of the alternatives.

This paper is published with the permission of the Minister of Highways, British Columbia. The writers are indebted to F. T. Brown, Chief Engineer, Department of Highways, B. C., for his support and encouragement throughout the work.

Bridge across the Platte was built in 142 working days. Rig built by contractor sets prestressed beams for 110-ft spans. Sand forms cells, which were dewatered as needed by wellpoints. ▶

Piers are under construction in cell area dewatered by wellpoints. ▼

Bridging the Platte

on a tight schedule

K. W. PHILO, A.M. ASCE, Project Superintendent

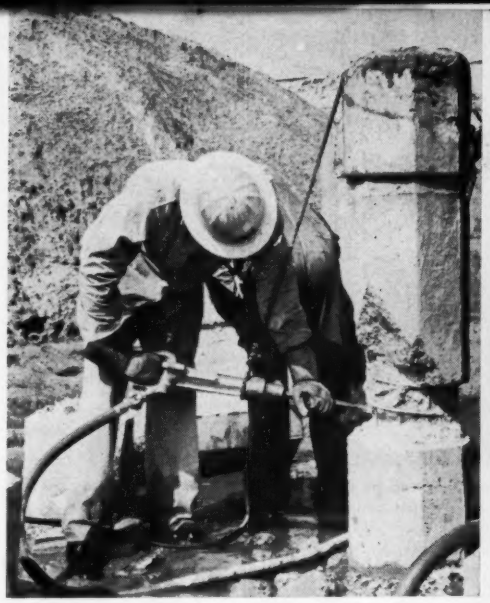
Massman Construction Company, Kansas City, Mo.

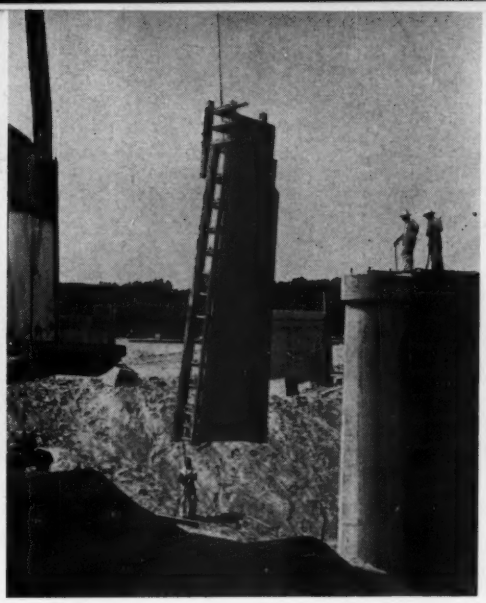
By pushing the Platte River around, using wellpoints to dry out work areas, and placing precast stringers with a specially fabricated rig, twin 1,540-ft bridges on Interstate 80 near Lincoln, Nebr., reached usable completion in 142 working days. Massman Construction Company of Kansas City did the work for the Nebraska Department of Roads. Cooperation of the John W. Stang Corporation, the Burlington (C.B.&Q.) Railroad, the Nebraska Prestress Corporation and the Omaha Ready Mix Corporation, made the rapid construction possible and the venture a success.

The twin structures are 88 ft apart; each has fourteen spans 110 ft long with a deck 24 ft wide. State forces designed the structure. The 26 piers have separate, pile-supported footings and a modified dumbbell shape with a solid web up to the cap. Abutments, also on piles, are tied back to anchorages in the approach fill. Curtain walls of the abutments and anchorage units are precast members.

A rapid construction schedule

In planning this job for completion in 165 working days, the timetable was all-important. To meet the requirements of the schedule an unusual plan was evolved. Construction was started on the south side of the river because of rail and road access. The river was diverted to the north side as far as possible and the substructure built with the protection of sand dikes and a wellpoint dewatering system. A rail spur was built from the main C.B. & Q. line parallel to the bridge and extended across the river on the upstream dike as pier construction proceeded. This spur was to be used primarily to deliver shipments of piles and prestressed beams. When the





FAR LEFT: Piles are cut off by concrete breaker in preparation for footing construction.

NEAR LEFT: Construction was speeded by use of prefabricated pier forms.

substructure construction had been pushed as far north as possible, the river was diverted through a trestle and under the completed south spans while construction of the bridge continued to the north abutment.

In the first 30 days of work at the site, a construction yard and office were set up. Forms for piers were built and reinforcing prefabricated. Four crawler cranes were given primary assignments as follows: a Northwest Model 95 with a 3¼-cu yd dragline bucket, dike building and excavation; a 3½-cu yd Manitowoc 3900, pile-driving; a 2-cu yd Northwest 80 D, setting forms and concreting; and a 1-cu yd Northwest Model 6, wellpoint handling. Before starting their regular assignments, some of the other rigs helped with excavation.

As soon as river conditions permitted, work was begun on the abutment and the dike. The latter was started 1,000 ft upstream and angled out to midstream at the bridge site to protect separately excavated areas for the 12 piers at the south end. The regular work week was six 9-hour shifts but construction of the dike—and later, shifting it to the other side of the river—was pushed on an around-the-clock basis.

Open cells, enclosing a pier for one of each of the twin bridges, were built of sand by constructing an upstream and downstream dike 100 ft each way from the centerline between the bridges. Cross dikes were then built between piers, spaced 110 ft on centers. As the upstream dike was extended, a rail spur was constructed on it; the surface of the downstream dike was covered with rock to make a haul road. See Fig. 1.

A line of Stang wellpoints was laid longitudinally along each end of the piers with a cross line midway between the piers to form a rectangle, or "ring," 110 ft by 164 ft around each pier site. Four rings were pumped at a time while a fifth was being leapfrogged ahead to a new location. With eight pumps of 12- and 16-in. size working, the system could remove up to 30,000 gpm to keep the excavation dry to a depth of 20 ft.

A week after pumping began, driving could start on the first of the 14 long prestressed concrete piles required under each of the 26 piers. The 14-in. octagon-shaped piles were fabricated by Nebraska Prestress Corporation in 95- and 75-ft lengths and delivered by rail from their plant at Lincoln, some 30 miles from the work site. The big piles were handled by a crawler crane, with leads 127 ft long attached to the crane at the top of the boom and controlled at the bottom by an adjustable frame that provided for driving nearly half of them on a batter of 2 in. per ft. A Link Belt model 520 diesel hammer was used to drive a total of 408 piles. Jetting was not needed as the heavy piles were sunk readily through the sand.

Since four cells could be dewatered at one time, construction operations were grouped for a production-line operation. In cell one, excavation and pile driving proceeded; in cell two, any excess lengths of piles were cut off, then forms were set and footings concreted; in cell three, reinforcement was placed, then pier forms for the full height; in cell four, the piers were concreted and the forms stripped.

Pier construction was facilitated by the use of prefabricated wooden forms. Footing forms were boxed and tied on the dikes ready for use. When the pile cutoff and fine grading were completed, it was only a matter of hours to set forms and place concrete for the four footings in each cell. The upper pier forms were fabricated in six pieces. Reinforcing, including the web walls, was also prefabricated, which permitted handling the upper pier reinforcing in only four units—two columns, a web wall and a cap.

Placing the 56-ton prestressed beams, 110 ft long, was done with a

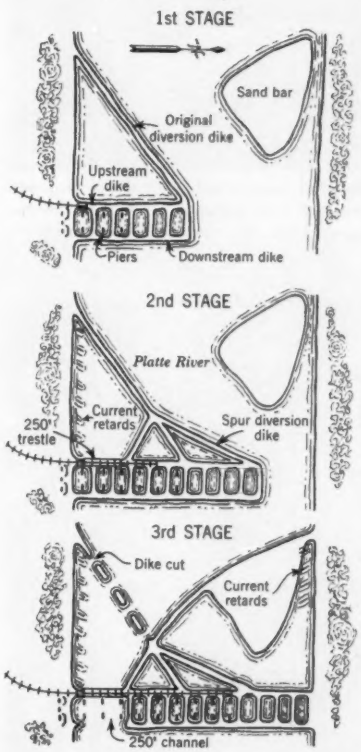
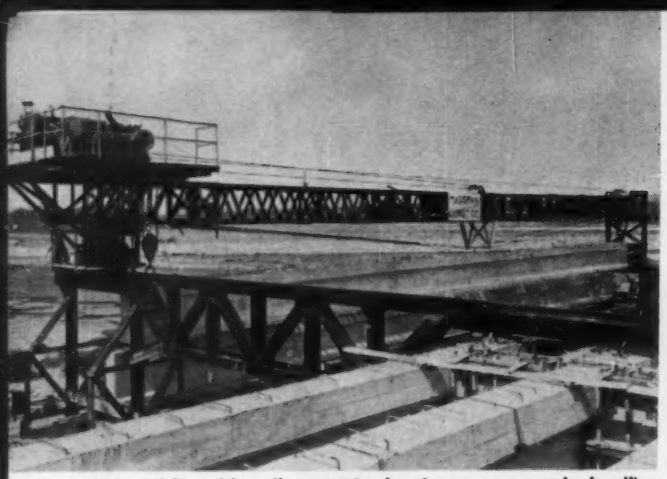
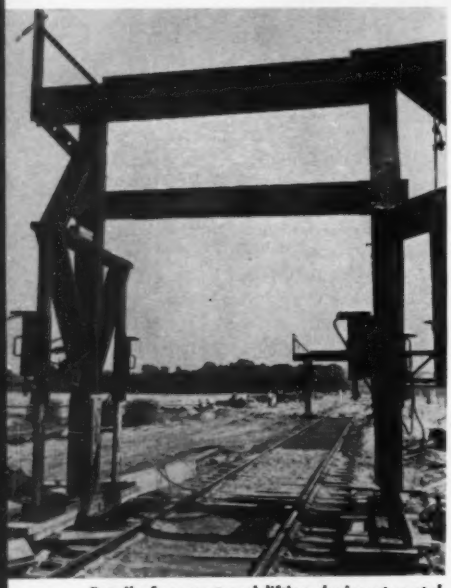


FIG. 1. How the Platte River was pushed around to permit rapid construction of a bridge near Lincoln, Nebr.

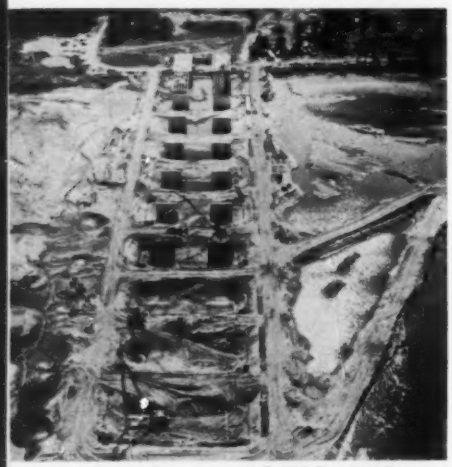


Beams, delivered by rail, are set in place in one movement by handling device designed and built by Massman. The portals and traveling bridge

crane are moved ahead on top of a load of beams. Trusses are moved separately by crawler crane.



Detail of support and lifting device at portal. Inverted jacks swing over car and lift the special crane for movement to next position.



Four or five areas, each 110 ft x 164 ft, were kept dry for construction by wellpoints. As much as 30,000 gpm was pumped.

minimum of handling by a crane that was Massman designed and fabricated. The big beams were fabricated by Nebraska Prestress Corporation and delivered along one side of the piers on three rail cars. A simple but strong frame, with a portal section straddling the track, was set up at each end of the span and a truss placed to connect the unit to the near pier; a rail beam carried the load across the first pier to a truss and beam for reaching the far pier of the pair. A traveling bridge crane, with a hook at each end, picked up the beam and moved laterally on rails with the precast member to its final position in the structure.

The bridge crane was picked up and moved ahead by rail on top of the beams destined for the next span (see photo). The trusses and other members carrying the rail for lateral travel were moved and set by the crawler crane, a procedure that could be completed in one working day.

As soon as the beams were erected, stiffening diaphragms were formed between them. Adjustable prefabricated wooden forms were used to allow for minor variations in the beams as set. Enough deck forms were provided for eight 110-ft spans, four on each bridge. These were hung from the beams by removable bolts. Reinforcing was set and tied in place. Concrete brought in by ready-mix truck was delivered direct to the deck by crane and bucket. Use of a Master bridge deck finisher permitted placing the concrete for the 24-ft-wide deck of a 110-ft span in three hours.

Pushing the Platte around

One of the more important time-saving features of the job was the method used to divert the river from the north side of its bed to the south side and under the completed spans without slowing the bridge construction. Initially the river had been pushed north, ahead of the pier construction, by the angled diversion dike. A spur diversion dike pushed the river further beyond Pier 10.

When the pile driving crew completed Pier 10, they moved back onto the upstream dike and constructed a pile-bent trestle 20 ft wide and 250 ft long alongside Piers 1 to 3. The trestle was constructed 20 ft outside the temporary rail spur and completed with no stoppage of rail or road traffic. The track was then simply pulled to alignment with the trestle rails—in one day. This trestle served rail and road traffic until the north bank was reached.

During the time that excavation was being done in the upstream and downstream dikes for the 250-ft channel, the pile-driving crew constructed eight current retards, made of trees, along the south bank. These retards were built in the dry behind the protection of the diversion dike. On completion of the retards along the south bank, the diversion dike was cut and the river allowed to flow under the trestle.

After the river channel had been successfully shifted, the remaining piers and the north abutments were quickly constructed. Retards along the north bank were built in the dry. On completion of the prestressed-beam erection, the rail spur was taken up. When deck concreting was completed, 142 working days after the start of construction, the sand dikes were cut between every pier and the 250-ft-long trestle removed. Placing the guard rail and clean-up completed the job.

The organization that accomplished this project was directed from the Kansas City office of the Massman Construction Company by Vice-President George E. Owens. The author was in direct charge in the field. The cooperation of the Nebraska Department of Roads and of Resident Engineer Kenneth Johnson is gratefully acknowledged.

Composite floor

installed in an existing building to carry extra loads

ARNOLDO LONGORIA, Project Engineer, H. E. Bovay, Jr., Consulting Engineers, Houston, Tex.

When the load capacity of a floor in an existing building in Houston, Tex., had to be upgraded from 170 to 225 psf, composite construction was found to be the answer. Electronic data processing equipment was to be installed on the seventh floor of the 22-story Texas Eastern Building (formerly the First City National Bank Building). While the floor had to be made capable of supporting this heavy equipment, the work had to be accomplished without disturbing tenants of the occupied building.

An investigation revealed that the steel columns, girders and floor deck were adequate to sustain the load, but that the floor beams would be overstressed. This investigation was made for the owner, American General Life Insurance Co., by H. E. Bovay, Jr., consulting engineers. The structural steel building has a cellular steel floor deck with lightweight-concrete floor fill and suspended acoustical ceilings.

A simple solution would have been to add floor beams. This was rejected because the suspended ceiling on the sixth floor would have had to be removed, with resulting disturbance to tenants there. Raising of the new beams from ground level to the sixth floor would have posed other problems and created additional disturbance. Also considered was the construction of a false floor supported by new beams placed on the existing girders. However, this would have reduced the existing floor-to-ceiling height by one foot, creating problems in vertical clearance for the ventilating duct work. In addition there would have been problems in laying conduit, and again, difficulty in raising the 19-ft-long 10 WF 21 beams to the seventh floor. Construction cost estimates for each of these two schemes were considered excessive.

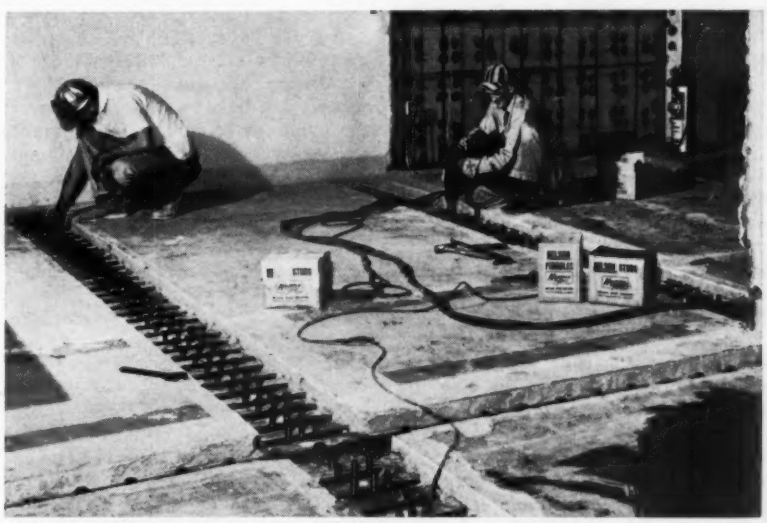
Consideration was then given to converting the existing steel floor beams into Nelson composite (concrete-steel) beams by means of shear-connector studs, which cause the beams and an overlying concrete slab to act as a unit. Use of this method would not reduce the existing floor-to-ceiling height. Materials and equipment required could easily be conveyed to the seventh floor, and the work could be accomplished with little disturbance to tenants of the building.

The composite construction was accomplished by first removing part of the concrete floor fill to expose the cellular deck over each floor beam. Slots were then cut in the deck exposing the top flanges of the beams beneath. Granular flux-filled, steel, Nelson shear connector studs were end-welded to the beam flanges. The semi-automatic stud welding gun easily reached through the slots to weld three studs between all cells in the decking. Because of the shallow depth between the beams and the existing floor surface, threaded studs were used instead of the longer headed shear connector studs. Nuts run down on each stud perform as heads.

A dry-mix expansive grout was placed between the top of the beams and the horizontal part of the decking between cells. This was necessary because of the close clearance and to prevent concrete leakage to the ceiling below. The grout was tightly packed by hand, allowed to set, and then checked before the structural concrete was deposited above it.

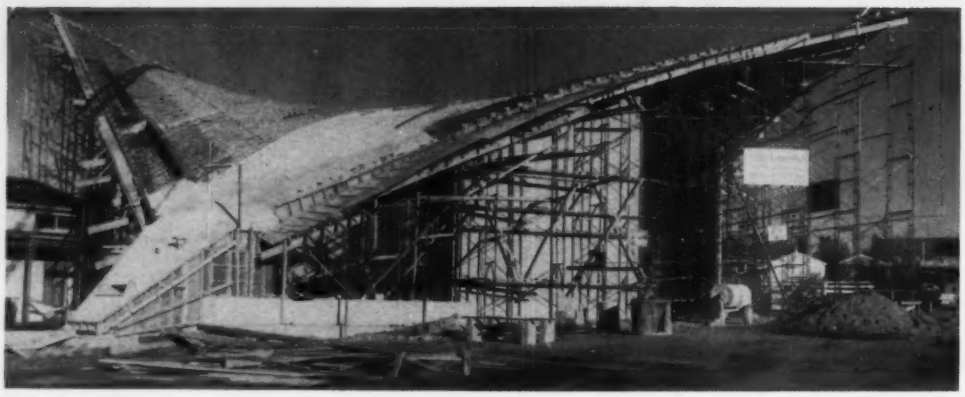
Increasing the floor load capacity by composite construction cost 33 percent less than the estimated cost for the least expensive alternate method.

Arnoldo Longoria of H. E. Bovay, Jr., consulting engineers, supervised the structural design and Marvin Mitchell of that firm, the mechanical design. W. S. Bellows Construction Corporation was the general contractor. Shear connectors were furnished by the Nelson Stud Welding Division of Gregory Industries, Inc., Lorain, Ohio, which holds the patent for the Nelson composite beam employed in this construction.



Nelson threaded studs were end-welded to floor-beam flanges with a semi-automatic welding gun. Then nuts were applied to serve as heads. Previously floor fill had been removed and slots cut into the cellular steel deck underneath.

Hyperbolic paraboloid



Forms are still in place after concrete for abutments has been placed. Bands of Haydite concrete 20 ft wide were poured alternately with bands of hardrock concrete 10 ft wide until the shell was complete.

CARL H. JOHNSON, Funk, Murray & Johnson, Spokane, Wash.

The St. Charles Church in Spokane, Wash., is of special interest to engineers chiefly because of its roof—a hyperbolic paraboloid formed of thin-shell concrete. The overall dimensions of the post-tensioned roof shell are 140 ft by 151 ft, and the shell thickness varies from 3 to 5 in.

This unusual roof was actually a by-product of the plan chosen for the church. First consideration was given to developing a plan that would function as desired by Father O'Connor, pastor of St. Charles. One feature he considered most important was to get all the occupants within a reasonable distance of the altar. A pie-shaped plan aided in achieving this. A comparison of a conventional rectangular space seating 800 people and a pie-shaped space seating 800 shows immediately that the distance to the rear wall is much less in the pie-shaped area.

Many other factors were considered before arriving at a plan that satisfied the requirements. See Fig. 1.

Only after the plan had been chosen did we begin to consider various ways of roofing the area. Several preliminary studies were made employing conventional framing systems, but none excited our fancy until we began to investigate the feasibility of using a hyperbolic paraboloid shell.

This relatively new concrete roof shape derives its name from the fact that any transverse-vertical cut through the shell will produce a parabolic curve in section, and a horizontal cut will produce a hyperbolic curve in plan. One factor in the growing popularity of this apparently complex form is the seemingly contradictory characteristics of its shape. Although the hyperbolic paraboloid is curved in two directions, it is composed entirely of straight lines!

The form used at St. Charles is only a part of a true basic hyperbolic paraboloid, illustrated by the shaded areas of various views of the shell, Fig. 2. The dotted lines in each case show the outline of the basic form, and the shaded areas, that part of it used for the St. Charles Church. The outstanding characteristic of this form is that any vertical cut parallel to either edge will produce a straight line at the shell surface, thus permitting the use of straight lumber for the forms.

Analysis of hyperbolic paraboloids reveals some amazing properties. Nervi, eminent Italian engineer, has called them "form-resistant," that is, structures that are strong because of their form.

Analysis has revealed that, under its own weight and a uniform load, a hyperbolic paraboloid shell develops stresses that have the same value over the entire surface. These membrane stresses are such that their resultant follows the edge of the shell toward the abutment. Hence the edge beams have an axial compressive load theoretically varying from zero at the tip of the shell to a maximum at the abutment. This means that no bending movements are developed in the edge beam except those of a secondary nature. What form could be more efficient?

Rough preliminary calculations using the Portland Cement Association's "Elementary Analysis of Hyperbolic Paraboloid Shells" indicated that a shell of this type might be a possible solution to the roof problem for this church, although at the time (late in 1958) we could find no example of a single shell approaching the size of the one proposed—140 ft x 151 ft.

About this time T. Y. Lin, F. ASCE, an internationally known authority on prestressed concrete, came to Spokane on other business. The proposed shell at St. Charles was mentioned to him and he later became the constultant on the prestressing phase of the design. When his office started actual calculations it became evident that the structure was considerably more complicated than had been anticipated. His assistance and guidance in solving the complex problems involved were major contributions to the successful realization of the design.

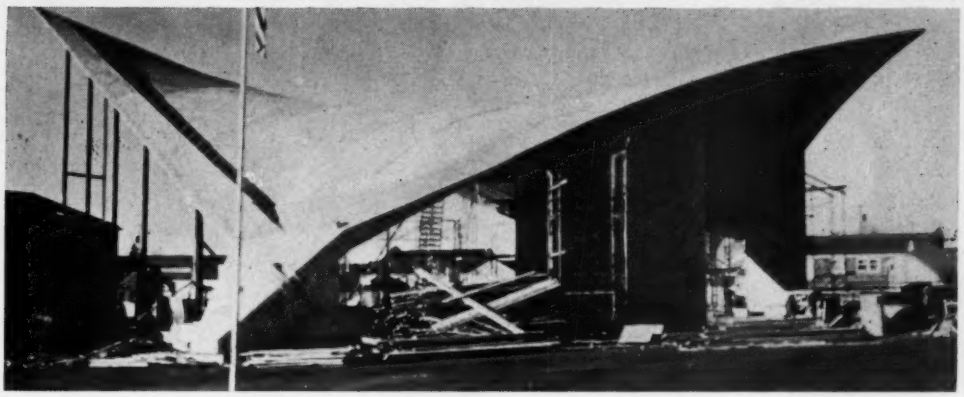
Problems of stability

Among the many unusual problems that had to be solved were those of bringing an obviously unbalanced shape into stability, and the disposition of the edge beams. A look at the plan, Fig. 1, will reveal some limitations that might cause an engineer to wish he were something else.

The kite-like shape (Fig. 3) contains a post-tensioned tie-beam between abutments, and walls and window mullions as shown. Heavy load-bearing beams or columns were to be avoided if at all possible. So we resorted to the use of two types of concrete for the shell, of different weights but the same strength, post-tensioned by cables both longitudinally and transversely, to help to bring the structure into balance. Stability is further improved by the "tie-down" reinforcing which extends through two walls into masses of concrete below the floor line, enabling the structure to be self-supporting.

But it was still felt that edge beams would be necessary on a shell of this

roof for a church



Only after the shell had taken its natural deflection due to dead load were the columns set in place.

size. To achieve the best appearance, and I think the simplest form, we thickened the edge of the shell on the upper rather than the lower surface, as shown in Fig. 3, Section A-A.

Two types of concrete

The two types of concrete used in the shell were called "hardrock" and "Haydite." The heavier concrete, called ""hardrock" because it contains normal sand and gravel aggregate, weighs about 150 lb per cu ft. It was used 5 in. thick for the shell on the short side of the tie-beam. See Fig. 3. The lighter concrete, called "Haydite" from the trade name for the expanded shale aggregate used in it, weighs about 110 lb per cu ft. This lighter concrete was used 3 in. thick on the wider side of the tie-beam.

The design strength for both types of concrete was 5,000 psi at 28 days. The strength of the Haydite concrete closely approaches that of the concrete containing sand and gravel for aggregate but its insulating value is much greater. Also its cost is greater per cubic yard although this is sometimes offset by savings resulting from reduced total weight of structure.

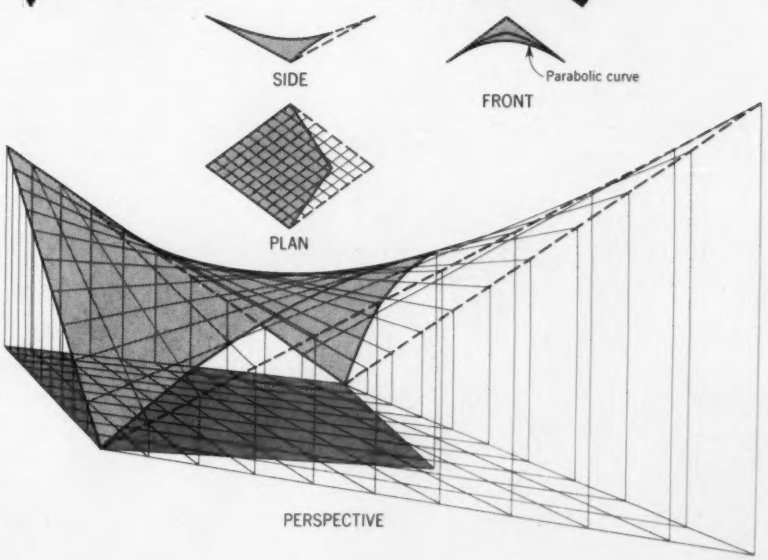
Both mixes were designed by a premixing plant to attain the specified strength. Exact proportions of cement, water and aggregate were thus the responsibility of the premix plant. Test cylinders were taken during placing operations to show the actual strengths attained.

Stressing cables throughout the shell consist of four ¼-in. wire strands coated and wrapped with Sisalcraft paper to prevent bond between the wire and the concrete, thus permitting post-tensioning after the concrete had

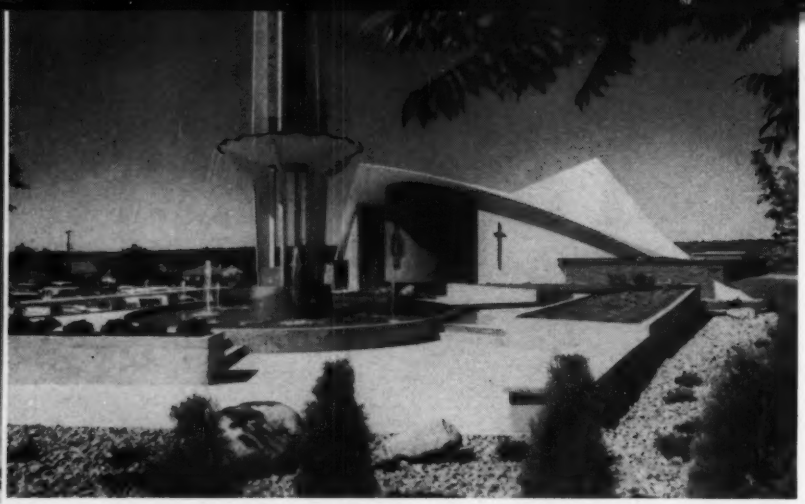
FIG. 1. Pie-shaped plan for St. Charles Church proved functionally advantageous as compared with conventional rectangular arrangement.

C Confessionals
E Exits
F Fountains
L Literature rack
M Mechanical
P Pulpit
S Shrine

FIG. 2. Curve used for roof (shaded area) is only part of a true basic hyperbolic paraboloid.



Tower of completed church has total height, including cross, of 96 ft.



Tower legs were fabricated by welding steel plate together. Between the legs are grilles of pierced copper, behind which tube lights produce a "glowing" effect at night.

attained a minimum compressive strength of 3,500 psi. The cable spacing varies from 12 to 24 in.

Construction

Tubular metal scaffolding, set up in rows parallel to one edge of the shell, was used to support the form stringers, consisting of 2 x 10's spaced 5 and 7 ft on centers. Across the stringers 2 x 4's were laid at 24 in. on centers, then 1 x 6 strips at 16 in. on centers, which support Rockwood insulation 1½ in. thick. The rigid insulation serves in three ways—as forming material, as shell insulation, and as a base for plastering.

The next step was to put in place the post-tensioning cable for the tie-beam between the abutments, and other reinforcing steel. Concrete for the tie-beam was then placed. This 36-in. x 14-in. concrete tie-beam encases 8 tensioning cables of twelve ¼-in. wires each. The tensile force developed by the tie-beam between abutments is approximately 600 kips.

Next shell concrete was placed starting with a band 20 ft wide between the two abutments. Nine days later, when this part of the shell had attained a minimum strength of 3,500 psi, post-tensioning was applied to the cables in this band of the shell. Then the two abutments were poured, followed by alternating transverse pours of Haydite and Hardrock concrete, until the concreting of the shell was completed. The Haydite pours were in bands 20 ft wide, the hardrock in bands 10 ft wide. The pours were made in the sequence shown in Fig. 3 to keep the form deadloads as nearly balanced as possible.

When the last pour had attained the desired strength, the cables running in the longitudinal direction through the shell were stressed, then the cables in the transverse direction, placing the entire shell in a compression of about 350 psi. Stressing of the tie-beam between abutments followed, making the structure self-supporting.

Now the forms were removed. Only after the shell had been permitted to take its natural deflection due to dead load were the columns set in place. Thus, theoretically, the columns begin to work only when live loads are added.

The total construction cost, including chipped glass windows in the amount of $30,000, was $344,000, which is believed to be fairly economical for a church seating 800 people. The multipurpose unit previously built is used on special occasions to seat an additional 400, making the maximum capacity 1,200.

The builder, Vern W. Johnson, an architect-engineer graduate of the University of Kansas, showed an immediate grasp of the geometric principle of the hyperbolic paraboloid and did a fine job of coordinating construction. The owner, the architects, and most parishioners are well pleased with the resulting structure, an unusual one for this area.

For this structure, Funk, Murray & Johnson were the architects; T. Y. Lin, F. ASCE, the consulting engineer for the prestressing phase; Carl H. Johnson, the structural engineer; Rice & Strecker, the mechanical engineers; and Joseph M. Doyle, the electrical engineer.

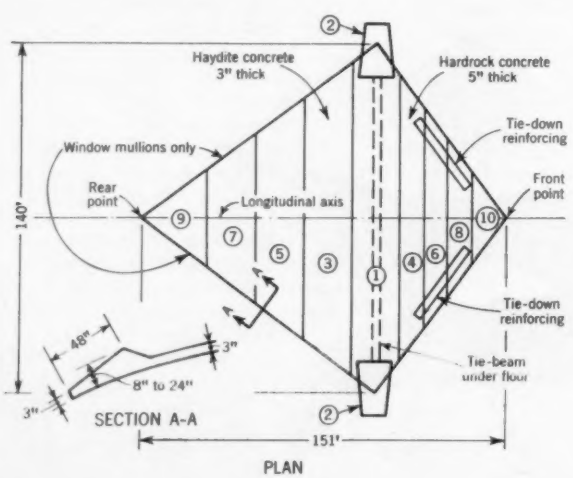


FIG. 3. Two types of concrete were used in the shell. Haydite concrete was placed in bands 20 ft wide, Hardrock in bands 10 ft wide. Concreting sequence was as follows:

AREA NO.	DESCRIPTION
(1)	Tie-beam, 36 x 14 in.
(1)	20-ft band of shell between abutments
(2)	Abutments
(3)	Haydite band of shell
(4)	Hardrock band of shell
(5)	Haydite band of shell
(6)	Hardrock band of shell
(7)	Haydite band of shell
(8)	Hardrock band of shell
(9)	Haydite band of shell
(10)	Hardrock band of shell

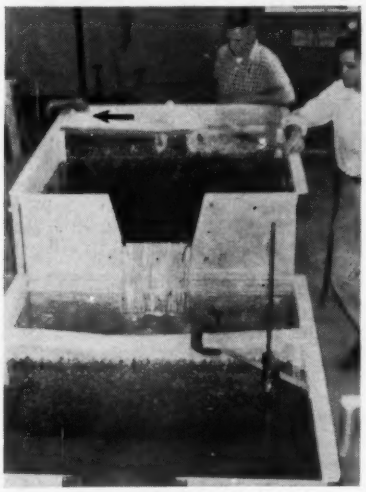
ENGINEERS' NOTEBOOK

Solution to a baffle problem

J. HAROLD ZOLLER, F. ASCE, Professor of Civil Engineering and Chairman,

College of Technology, University of New Hampshire, Durham, N. H.

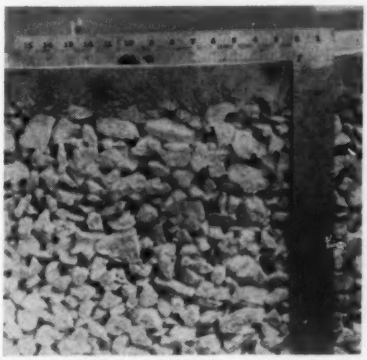
In 1956 personnel of the hydraulics laboratory at the University of Wyoming (where the writer was at that time professor of civil engineering) were faced with the biennial problem of renewing the rock-filled metal screens that served as energy suppressors to damp out eddy currents and turbulence in the various hydraulic-flow channels in the laboratory. Some of the confining wire had rusted through, releasing stones into the channels. In other places the screens sagged and bulged and the wooden frames had deteriorated and were in need of repainting. In an effort to cut maintenance costs and achieve a neater overall appearance, it was decided to rebuild the baffles with porous concrete, utilizing the same stone previously enclosed in the wire baffles.



Porus concrete baffles serve to reduce turbulence in flow channels at the hydraulics laboratory of the University of Wyoming. Downspout has been removed from the inlet pipe to provide maximum turbulence.

Forms were built to receive the stones, and small angles were fitted to the tanks to hold the baffles in position. After some experimenting, a method of mixing was found that resulted in coating each stone with a viscous mortar film varying in thickness from $\frac{1}{16}$ to $\frac{1}{8}$ in.

The method consisted essentially of adding to the mixer, first, the stones and enough water to wet them thoroughly. Then the cement was added rapidly in small amounts until a viscous paste surrounded each piece. Overmixing was avoided as it resulted in removing the paste from the stones and impacting it on the sides of the mixer. The mixture was then rodded into the forms and a cap of normal concrete added to prevent boundary deterioration. Tanks were flooded for a week to provide curing. It is worth noting that these baffles have been subjected to numerous cycles of wetting and drying and that they are in as good condition as ever after five years of service.



A porus concrete baffle is seen immediately after construction. Such baffles have proved effective in removing entrained air and in damping out most of the eddy currents.

THE READERS WRITE

Simple-frame versus rigid-frame powerhouse design

TO THE EDITOR: The article by B. L. McCorkle, "Steel Quantities for a Simple-Frame and a Rigid-Frame Powerhouse Compared," in the July issue, p. 37, has caused much discussion among power-plant designers and deserves serious rebuttal on the following counts:

1. The example is not typical of powerhouse framing.
2. The "rigid-frame" was not analyzed as such for handling lateral loading.
3. Even if the example were representative, the steel weights resulting from the two methods of analysis showed too small a difference to permit a positive conclusion.

Although the column spacing in the illustration is erratic enough to be acceptable for the problem, the same cannot be said of the beam spacing. It is not normal for columns to be braced at uniform distances, to have such short unsupported lengths, or to have the same unbraced dimensions about both axes. Nor are the continuous levels of beams at all characteristic. Frequently it is necessary to omit beams to clear duct work, coal bunkers, etc. The boiler usually requires a large cavity in the heart of the structure.

In the column design, an increase in size is attributed to the bending moment introduced from the rigid beam connection. No mention is made of the moment induced in the column as a result of eccentricity caused by the simple beam connection to the column flange in the other case. The article states that "it is difficult to determine the exact stresses in the lower stories because of the indeterminacy of column-base fixity." This is also true of a simple frame. The magnitude of the column dead loads in power stations is such that the columns are virtually fixed at the base.

In a true rigid frame all gravity loading and lateral forces are resisted by bending action of beams and columns, and joint rigidity is important. The frame referred to as "rigid" in the article is a hybrid, something between a diagonally braced system and a rigid frame.

Since the analysis of a rigid frame is rigorous and indeterminate, most engi-

neers prefer cross-bracing systems, for ease in computation. However, the analysis of a rigid frame can be a challenge. The slope deflection method was programmed by Sargent & Lundy for the Univac 1105 digital computer and has been in use since November 1959. This program takes into account the percentage of rigidity of various types of beam-column connections and either fully fixed or hinged column base restraints.

A number of considerations favor truly rigid-frame design, such as:

1. Complete elimination of cross bracing. This removes clearance and interference problems and the need for temporary bracing during erection of equipment—to take the place of permanent bracing that might be in the way.

2. Lower cost, since the unit price of a cross-braced powerhouse is higher than that of one designed as a rigid frame. If the cross bracing has to take compression forces, where equipment interference precludes the use of a purely tension bracing system, the cost is further increased.

3. No excessively large axial uplift or compressive forces due to lateral loads to cause a foundation design or construction problem. In a rigid frame each column shares in the distribution of the load.

This highly controversial subject is being discussed more and more. The advent of the digital computer has made it possible to obtain a solution to rigid-frame problems that was hitherto unattainable. In addition, should the use of plastic design for large frames become common practice, the pioneering work in rigid-frame analysis now being done will turn out to be very useful.

M. Zar, F. ASCE
Associate, Sargent & Lundy, Engineers
Chicago, Ill.

Author's reply

To the Editor: In discussing my article on a rigid frame versus a simple frame for a powerhouse, Mr. Zar has raised three main points:

1. The example is not typical because the columns: (*a*) are braced at uniform distances, (*b*) have the same unbraced dimension about both axes, and (*c*) have such short unsupported lengths. Items (*a*) and (*b*) should not affect the result significantly. As for (*c*), if longer unsupported lengths of columns are assumed it would penalize the rigid frame even more since column sections are inefficient in resisting the bending moments caused by rigid-frame design.

2. With regard to lateral loading, this article was the result of an objective study made to compare a simple frame and a rigid frame, both diagonally braced. Apparently Mr. Zar overlooked this as he makes several references to "true" rigid frames as compared to simple frames.

3. It is true that the 1.2 percent difference in steel between the two frames is small and that there are some advantages in a "true" rigid frame. There are also advantages in diagonally braced frames. The cost of both fabrication and erection of structural steel for a rigid-frame powerhouse is greater per pound than that for a simple frame. Therefore, unless the rigid frame can provide a substantial and conclusive saving in weight of steel, it is not economical for powerhouses. The resistance to side sway of a diagonally braced frame is about three times that of a non-diagonally braced rigid frame. This rigidity is often desirable and necessary, for example to avoid cracking of light masonry curtain-wall construction.

In these competitive times, I doubt seriously that a competent engineer would use simple-frame analysis because of the "ease of computation," particularly if he were certain he could save his client money by using rigid-frame design.

B. L. McCorkle, M. ASCE
Structural Design Engr.
Black & Veatch, Consulting Engineers
Kansas City, Mo.

Designing glass panels against wind

To the Editor: In my article, "Designing Glass Panels Against Wind," in the May issue, p. 72, I wish to make a few corrections.

In rearranging Eq. 1, I inadvertently used the value of F as $\frac{7.5}{5.5}$, whereas it should have been $\frac{(5.5)^2 + (7.5)^2}{2 \times 5.5 \times 7.5}$ or 1.048.

Then $t = (0.0377\ s)^{1/2}$

With safety factor $s = 10$, $t = 0.61$
With safety factor $s = 5$, $t = 0.43$
With safety factor $s = 2.5$, $t = 0.31$

Further along in the article, the rate of increase in the thickness of glass by the ASCE-ACI Joint Committee formula becomes

$$\frac{(0.0423\ s)^{1/2}}{(0.0377\ s)} = 1.06.$$

This correction indicates a closer agreement between the two formulas.

W. Rick Wallis, F. ASCE
Consulting Engineer
Fresno, Calif.

Underground uncertainties may unduly penalize owners

To the Editor: Apparently Mr. Borg, who wrote the article, "Who Pays for the Unexpected in Subsurface Construction?" (June 1961, p. 64) has never put himself in the position of a private owner who has embarked on a project involving subsurface excavation. Generally the prime consideration of such an owner is the ability to build within a fixed budget, which is limited by mortgage financing and the owner's available equity.

The owner wants to know what the outside cost of construction will be as his greatest fear is "extras." If Mr. Borg's suggestions are adopted, an owner would bear the risk of unlimited extras. In my opinion, most owners would prefer to have the contingency covering the unexpected contained within the lump-sum contract price. In this way the owner will be able to assure himself, the mortgagee, and other investors that the building will be completed within the available funds.

If a risk is to be taken as to what will be found underground, this risk should be borne by the person best qualified, both professionally and by experience, to calculate that risk. This is the excavation contractor, not the owner.

Mr. Borg's proposal should be reexamined in the light of the above considerations.

Charles J. Urstadt
Vice President, Webb & Knapp Construction Corp.
New York, N. Y.

TVA rates for electricity

To the Editor: I was disturbed to see a very misleading statement in "Do You Know That," in the August issue, to the effect that the TVA had cuts its rates to a national low.

The fact that the new rate was announced at a White House ceremony resulted in a completely unwarranted fanfare of publicity. It is merely another optional rate which municipalities and cooperatives, supplied by TVA, are permitted to make available to their customers—if they elect to do so.

The fact that the new rate is available does not mean that it will be used. Only two of TVA's 155 distributors (one municipality and one cooperative) immediately indicated that they would offer the new reduced rate. Prior to the announcement of the new optional rate only 34 of TVA's 155 distributors had seen fit to give their customers the benefit of the lowest optional retail rate then available to them; 78 distributors, more than half the total, were using the highest TVA-sanctioned rate.

Despite all the publicity, TVA did not cut its rates. All it did was authorize rate reductions by its distributors. The distinction is important inasmuch as government power advocates have so often described TVA as a "yardstick." This claim is of course ridiculous. A power producer that uses government funds, that is relieved of all income tax liability and enjoys other tax advantages, is not a valid measuring rod for judging the efficiency and economy of investor-owned utilities, which have no such favored status.

Many deeply resent what apparently was a plan to deceive the American public regarding TVA rates and I have felt compelled to bring the facts to your attention.

J. J. McDonough
President, Georgia Power Co.
Atlanta, Ga.

ASCE NEWS

Ten New Officers to Be Installed During Convention

G. Brooks Earnest

G. Brooks Earnest, a former Director and Vice President of ASCE, will take office in October as the 93rd President of the Society. A distinguished engineering educator, Dr. Earnest is now president of Fenn College, Cleveland.

Dr. Earnest is a 1927 graduate of Case Institute of Technology, receiving the Master of Science degree there in 1933 and the honorary degree of Doctor of Engineering in 1953. A member of the Case faculty for 21 years, he attained the rank of professor of engineering surveying. He left Case in 1951 to accept appointment as dean of the School of Engineering at Fenn College, and was elected president of the college in 1952.

Long prominent in ASCE, Dr. Earnest was president of the Cleveland Section in 1943; Director for District 9 from 1950 to 1952, and Vice President for Zone III in 1953 and 1954. He has also served the Society as representative to the Engineers Joint Council, as chairman of the Committee on Employment Conditions, and as Board Contact Member to the Committee on Student Chapters. He was a member of the Committee on Coordination of Professional Activities, which recommended formation of the Department of Conditions of Practice, and was subsequently vice chairman and chairman of the Department. Under his chairmanship, the Department of Conditions of Practice held its first meeting. Dr. Earnest has been a member of the ASCE-AIA Joint Cooperative Committee, holding the co-chairmanship in 1953 and 1954. More recently he has been a member of the ASCE Task Committee on Administrative Procedure.

ASCE President-Elect Earnest

Dr. Earnest has many other professional affiliations. He has been president of the Cleveland Technical Societies Council (1946-1947), the Cleveland Society of Professional Engineers (1951), and the Cleveland Engineering Society (1959-1960).

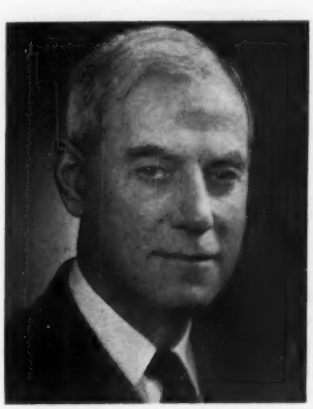
He was associate director of the Cleveland Regional Geodetic Survey from 1937 to 1944, and consulting director for the administration of field and office-force operations from the latter year through 1960. He organized the first large-scale city-mapping program using photogrammetric procedures. His numerous articles in connection with the Cleveland Survey have appeared in publications of ASCE and the American Congress on Surveying and Mapping, and in the technical press. He has also contributed articles on other subjects to CIVIL ENGINEERING and to *College and University Business.*

During World War II, in addition to his teaching duties, Dr. Earnest was executive secretary to the president of Case, assisting in developing the Navy V-12 program, and faculty adviser to several student organizations. He has given freely of his time and abilities to civic and allied activities. He was on the Mayor's Committee on City Planning, which recommended the existing City Planning Department setup for Cleveland, and on the Advisory Committee to the Cleveland Transit Board, which made recommendations pertaining to the rapid-transit program now in force.

Carey H. Brown

Carey H. Brown, new Vice President for Zone I, has served ASCE in many capacities. From 1934 to his retirement in 1954 he was with the Eastman Kodak Company at Rochester, N.Y.—during much of the period as manager of engineering and services at the Kodak Park Works. In the war years he was assigned to the Tennessee Eastman Corporation, a subsidiary of Eastman Kodak, for duty at the Holston Ordnance Works, Kingsport, Tenn., where he supervised construction and operation of a plant for the manufacture of high explosives.

A 1910 graduate of the U.S. Military Academy, Mr. Brown was in the Corps of Engineers from 1910 to 1930. His years in the Corps included duty with engineer troops in the United States, Mexico, and Panama, and with the A.E.F. in France; service as assistant engineer commissioner of the District of Columbia and engineer of the National Capitol Park and Planning Commission; and a term as director of civil and military engineering at the Army Engineer School. His present home is in Scottsville, N.Y., where he is a part-time farmer.



CAREY H. BROWN
Vice President, Zone I

A member of ASCE since 1926, Mr. Brown has served on many Society committees, been Director for District 3, and president of the Rochester Section. He is currently chairman of the Society's Committee on National

Water Policy. He has also been active in the Rochester Section of ASME and in the Rochester Engineering Society. He has been a member of the Water Resources Task Force and the Water Policy Panel of Engineers Joint Council; chairman of the Engineering Manpower Commission of EJC; and member of the Task Force on Water Resources and Power of the Commission on Organization of the Executive Branch of the Federal Government (Second Hoover Commission).

Burton G. Dwyre

Burton G. Dwyre, a highway engineering expert and former Director of ASCE, now joins the Board of Direction as Vice President for Zone IV. His home is in Santa Fe, N. Mex., where he is chief highway engineer for Gordon Herkenhoff and Associates.

From 1920 to 1925 Mr. Dwyre was with the New Mexico State Highway Department, and from 1925 to 1935 he was county engineer for Grant County, N. Mex. During part of the latter period he was also county surveyor for Grant County and city engineer for Silver City, N. Mex. In the period between 1935 and 1952 he was assistant state highway engineer for New Mexico and state highway engineer. In the latter year he became executive vice president and general manager of the Tellyer Concrete Pipe Company, New Mexico and Texas, remaining until 1955 when he became connected with Gordon Herkenhoff and Associates.

A long-time member of ASCE, Mr. Dwyre was Director for District 15 from 1951 to 1953. He is a member of the ASCE Task Committee on Professional Practice and a past president of the New Mexico Section. For many years he served on the New Mexico State Board for Registration of Professional Engineers and Land Surveyors, and in 1940-1941 was president of the Western Association of State Highway Officials. Currently he is on the Planning and Design Policies Committee of the American Association of State Highway Officials.

David G. Baillie, Jr.

New Director David G. Baillie, a New York City consultant and specialist in tunnel construction, will represent District 1 on the Board of Direction. He is a graduate of Brooklyn Polytechnic Institute, where he received the C.E. degree after earlier study at Los Angeles Polytechnic Junior College and Stanford University. After overseas services with the 115th Engineers in World War I, he was employed in New York City on various subaqueous tunnel projects for rapid transit and railroad services.

From 1934 to 1936 Mr. Baillie was resident engineer inspector for the Public Works Administration on the construction of the first tube for the Lincoln Tunnel and as chief engineer inspector on the construction of intercepting sewers in Manhattan and the Bronx. In 1936 he joined the staff of the New York City Tunnel Authority, which he served as senior civil engineer and assistant to the chief engineer during the planning, design, and construction of the Queens-Midtown Tunnel and Brooklyn-Battery Tunnel.

In the decade between 1951 and 1961 Mr. Baillie was general partner in the consulting firm of Singstad & Baillie. Major projects planned, designed and supervised by the firm during this period include the Baltimore Harbor Tunnel, the Boston Harbor Tunnel (a companion tube to the Sumner vehicular tube), Memorial Tunnel (West Virginia Turnpike), and numerous other highway and railroad tunnels. Since April of this year Mr. Baillie has had his own consulting practice in New York City.

Long active in the Metropolitan Section, Mr. Baillie has served it as director, vice president, and president. His numerous committee assignments in the Section include the chairmanship of the Section's drive for member contributions to the United Engineering Center. In his 25-year connection with the Society, he has served as chairman of the Committee on Registration of Engineers and chairman of the Tellers' Committee.

N. A. Christensen

N. A. Christensen, newly elected Director for District 3, is a well known engineering educator, who has been active in many causes concerned with professional development and betterment.

A 1925 graduate of Brigham Young University, he subsequently did graduate work at the University of Wisconsin and California Institute of Technology, receiving the Ph.D. degree in civil engineering from Caltech in 1938. From 1938 to 1948 he was dean of engineering at Colorado State University and director of the engineering division of the Experiment Station there. During the war he was on leave from the university as chief of re-

BURTON G. DWYRE
Vice President, Zone IV

DAVID G. BAILLIE, JR.
Director, District 1

N. A. CHRISTENSEN
Director, District 3

search for the Army's Rocket Research Division at Aberdeen Proving Ground. Since 1948 he has been director of the Cornell University School of Civil Engineering. He has been consultant on engineering problems to numerous agencies and groups, including the AEC's Brookhaven National Laboratory and Argonne National Laboratory and the Ordnance Office of Research at Durham, N.C.

Professor Christensen's interest in engineering education has manifested itself in continuous service to the American Society for Engineering Education and the Engineers Council for Professional Development. He served on the ASEE's Grinter Committee on the Evaluation of Engineering Education and was a conferee at the three recent Conferences on Civil Engineering Education, sponsored by ASCE, ASEE, the National Science Foundation, and the Cooper Union School of Engineering. At present he is a member of the ASEE's Ethics Committee and co-chairman of a committee for the preparation of a case book on engineering ethics.

Active in ASCE since 1938, Professor Christensen has been a member of the executive committee of the Irrigation and Drainage Division since 1957. He has also represented ASCE on several ECPD committees. At local level, he has been president of the Ithaca Section and a member of the District 3 Council.

CHARLES W. YODER
Director, District 7

HENDERSON E. McGEE
Director, District 11

Waldo E. Smith

Waldo E. Smith, new ASCE Director for District 5, has served as executive secretary of the American Geophysical Union for the past seventeen years, also fulfilling the functions of editor of AGU's *Transactions* and *Geophysical Monograph Series*. During most of this time, he has also been professorial lecturer in civil engineering at George Washington University. In his capacity as executive secretary of the AGU, he has been a member of the official U.S. delegations to a number of General Assemblies of the International Union of Geodesy and Geophysics. For the Thirteenth General Assembly, to be held in Berkeley, Calif., in 1963, he has been designated executive secretary of the Committee on Arrangements.

Since moving to Washington in 1940, Mr. Smith has been active in the National Capital Section of ASCE, serving as president in 1951-1952. He is currently one of the two representatives of ASCE on the Council of the American Association for the Advancement of Science and is on the Local Qualifications Committee of ASCE.

Prior to 1944, Mr. Smith was engaged as a hydraulic engineer for, respectively, the Corps of Engineers, the U.S. Department of Agriculture, and the Bureau of Public Roads. From 1935 to 1939, he was hydraulic engineer for the Muskingum Watershed Conservancy District in Ohio on the planning, construction, and operation of the fourteen flood-control and water-conservation dams in the Muskingum Watershed.

Earlier he served as assistant professor of civil engineering at North Dakota State College (now North Dakota State University), organizing the Student Chapter of ASCE there. For three years he served as associate professor of civil engineering and acting head of the department at Robert College in Istanbul, Turkey.

From 1919 to 1924, Mr. Smith was a student in civil engineering at the University of Iowa, taking his baccalaureate degree in 1923, and his master's degree as a Fellow in Hydraulic Engineering in 1924. In 1918, he served in the Army. At the University of Iowa, he was a member of the ROTC and was commissioned in the Engineer Reserves, in which he continued for eight years.

Charles W. Yoder

The professional career of Charles W. Yoder, new Director for District 7, has been predominantly in construction—the first ten years in the field and the remainder in design. He now heads the Milwaukee consulting firm bearing his name, which was founded in 1953. Prior to forming his firm Mr. Yoder was structural engineer for the Portland Cement Association for eight years and structural engineer on buildings and bridges for the Penn Railway Co., for three years. He is a civil engineering graduate of Pennsylvania State University.

His present firm, Charles W. Yoder & Associates, is active in the field of buildings, bridges, and highways. Representative projects of the firm include a new $1,000,000 automatic concrete-products plant in Milwaukee; the new South Oneida Street bascule bridge for the City of Appleton, Wis.; and reconstruction of West Silver Spring Drive, an urban artery, in Milwaukee.

A member of ASCE since 1935, Mr. Yoder has been chairman of the Committee on Local Sections, the Committee on Employment Conditions, and the Committee on Professional Practice; vice chairman of the Task Committee on Educational Aspects of Electronic Computation; and member of numerous other committees. At local level, he has served the Wisconsin Section as director, secretary-treasurer, and president, and has worked on numerous committees.

Another of his professional interests is lecturing at institutes conducted by Marquette University and the University of Wisconsin. He is a frequent contributor to CIVIL ENGINEERING.

Henderson E. McGee

Henderson E. McGee, new Director for District 11, comes to the Board from Sacramento, Calif., where he has had a long career in the U. S. Army Engineer District. A native Californian, Mr. McGee is a 1927 graduate of the University of the Pacific. For a few months after gradua-

LELAND J. WALKER
Director, District 12

ROY M. GREEN
Director, District 16

tion he was in the office of the City Engineer of Stockton.

Since November 1927, Mr. McGee has been with the U. S. Army Engineer District in increasingly responsible engineering work, ranging from an initial assignment as junior engineer on the construction of the San Joaquin River Deep Water Channel to his current assignment (1961) as assistant chief (for military works) of the Engineering Division. In his 34-year tenure with the Corps, he has been principally concerned with the management and administration of design forces for a wide variety of projects in the military and construction fields. Types of work on which he has been engaged include shallow and deep-draft navigation channels, flood control works, reservoirs for the retention of hydraulic mining debris, and the development of facilities at Army and Air Force installations. In addition, Mr. McGee participated in the Veterans Administration hospital program after World War II, and in the Army's Underground Explosion Test Program in Utah and Colorado from 1947 to 1949.

A member of ASCE since 1928, Mr. McGee has served as chairman of the Society's Committee on Salaries. He has also been member and chairman of various standing committees of the Sacramento Section, which he has also served as first and second vice president and as president. On-the-job training for junior engineers is one of his numerous professional interests.

Honors accorded Mr. McGee include the 1958 Engineer-of-the-Year Award of the Engineering Council of Sacramento Valley.

Leland J. Walker

New ASCE Director Leland J. Walker is president of the Northern Testing Laboratories of Great Falls, Glasgow, and Billings, Mont. He lives in Great Falls, and will represent District 12 on the Board of Direction.

A 1944 graduate of Iowa State University, Mr. Walker also attended Montana State College and the University of Colorado. From 1943 to 1946, he served in the U. S. Navy Civil Engineer Corps. Later he was with the Navy Research and Evaluation Center at Port Hueneme, Calif., on concrete research; with the Bureau of Reclamation in its Earth Materials Laboratory at Denver, as district materials engineer at Billings, and as chief concrete inspector and materials engineer on the construction of Tiber Dam; and vice president of William Wenzel and Associates, consulting municipal engineers. The Northern Testing Laboratories, founded by Mr. Walker in 1958, provides field and laboratory control testing and consulting services to engineers and the construction industry.

Joining ASCE as Junior Member in 1944, Mr. Walker has been vice president and president of both the Montana Section and its North Central Branch. In 1959 he was general chairman of the Pacific Northwest Conference, which was held in Helena. In the same year he represented the Montana Section on a Joint Committee that organized the Montana Technical Council, and he currently represents the Section on the Council and on the ASCE Committee on Adverse Weather Conditions. A specialist in materials testing, he is also a member of the American Society for Testing and Materials, Committee D-18 on Soils for Engineering Purposes. He played an important part in organizing the first joint meeting of professional engineers, consulting engineers, and architects in Montana, which has become an annual event.

Roy M. Green

Roy M. Green, a distinguished engineering educator, is the new Director for District 16. At present he is dean emeritus of the College of Engineering and Architecture at the University of Nebraska. Dean Green went to the University of Nebraska in 1943 as professor of civil engineering, and was dean from 1945 to his retirement in 1957.

Before joining the University of Nebraska faculty, he was for 23 years (1920-1943) president and manager of Western Laboratories at Lincoln, Nebr. In addition, for much of this period he was consulting engineer to the City of Lincoln. He has also been consultant to the St. Joseph (Mo.) Park Commission, the Nebraska Capitol Commission, the South Dakota State Highway Commission, the Omaha Airport, the City of Wichita, Kans., the Platte Valley Public Power and Irrigation District, and the Missouri River Division of the Corps of Engineers. In his early career he taught at the Texas Agricultural and Mechanical College, attaining the rank of professor. He is a civil engineering graduate of the University of Nebraska, class of 1914, and has a master's degree in highway engineering from Columbia University.

Long interested in raising professional standards, Dean Green has been secretary of the Nebraska State Board of Examiners for Professional Engineers and Architects since 1937, and for two years was chairman of the Board. He has served on accrediting and guidance committees of the Engineers' Council for Professional Development; on research and administrative councils of the American Society for Engineering Education; and as chairman of the Engineering Division of the Association of Land-Grant Colleges and Universities. Dean Green is also the author of numerous articles on engineering counseling.

A member of ASCE since 1919, Dean Green has been active in the Nebraska Section and is a past president.

Four Elected to Honorary Membership

Samuel B. Morris

New Honorary Member Samuel B. Morris is a former ASCE officer and consulting engineer to the Los Angeles Department of Water and Power. Widely known in West Coast water-supply circles, Mr. Morris was general manager and chief engineer of the Department from 1944 until 1955. Since his retirement in the latter year he has been part-time consultant to the Department and to a number of other organizations. During his tenure with the Department, a large number of reservoirs were constructed, dams rebuilt, and steam-generating plants undertaken. Outstanding projects include the Owens Gorge Power Project.

Before taking his post with the City of Los Angeles in 1944, Mr. Morris had been dean of the School of Engineering at Stanford University since 1936 and executive head of civil engineering since 1935. He was born in Los Angeles and graduated from Stanford, with a civil engineering degree, in 1911. From 1913 to 1935 he served the Pasadena Water Department as chief engineer and general manager. During this period he was responsible for the design and construction of Morris Dam, which was named in his honor and dedicated by Herbert Hoover in 1934.

Nationally known in his field, Mr. Morris has served as consultant to a number of government agencies as well as cities, utility districts, and water companies. A member of the President's Water Resources Policy Commission in 1950 and 1951, he is now a member of the Colorado River Board of California. He has served on the Committee on Geophysics and Geography of the Research and Development Board and as a member of the Advisory Panel on General Sciences, Research, and Development for the Department of Defense. In 1955 and 1956 he was a member of the panel on the impact of the peaceful uses of atomic energy, appointed by the Joint Congressional Committee on Atomic Energy, and in 1955 he was a member of the U. S. delegation to the International Conference on the Peaceful Uses of Atomic Energy, held in Geneva. He has been president of the American Water Works Association and the American Public Power Association, and vice president and director of the Seismological Society of America.

Active in the Society since 1922, Mr. Morris was Director from 1954 to 1956 and Vice President in 1958 and 1959. At local level, he has the distinction of having been president of both the San Francisco and Los Angeles Sections. Since 1957 Mr. Morris has been a director or alternate director of Engineers Joint Council.

SAMUEL B. MORRIS
Hon. M. ASCE

George S. Richardson

George S. Richardson, new Honorary Member of the Society and a consulting engineer of Pittsburgh, Pa., is especially well known in the field of highway and bridge engineering. His designs include numerous Allegheny and Ohio River bridges. In 1946 he planned the basic layout for the two-mile-long Downtown Interchange of Pittsburgh's Penn-Lincoln Parkway, said to be one of the most difficult freeway projects in the country.

A native of Colorado, Mr. Richardson graduated from the University of Colorado in 1920. He received the C. E. degree there in 1926, and in 1956 was awarded the honorary degree of Doctor of Engineering. In his early career he taught civil engineering for a year in the Towne Scientific School of the University of Pennsylvania, and worked as a structural detailer for the McClintic-Marshall Company (now part of Bethlehem Steel) and the American Bridge Company.

In 1924 Mr. Richardson entered the bridge design field with the Allegheny County Department of Public Works, advancing from draftsman to assistant chief engineer in 1937. For several years of this period he was bridge engineer for the Allegheny County Authority, set up by the county to administer funds from the Public Works Administration. In 1937 he entered the consulting field as a partner in Frick and Henderson, and in 1939 opened his own office in Pittsburgh, specializing in work on bridges, highways, and heavy industrial plant foundations. He organized the firm of Richardson, Gordon and Associates in 1955 and continues today as the senior partner. The firm also maintains a design office in Philadelphia.

GEORGE S. RICHARDSON
Hon. M. ASCE

A Pittsburgher since 1922, Mr. Richardson has found time for many civic interests and activities, including membership on the Municipal Affairs Committee and chairmanship of the Master Plan Committee. During much of the city's recent renaissance, Mr. Richardson has also served on coordinating committees for the Allegheny Conference on Community Development, as well as on the Mayor's Emergency Committee on Traffic Flow During Construction.

Active in ASCE since 1925, Mr. Richardson was Director for District 6 from 1955 to 1957. His many committee assignments during this period included the chairmanship of the Committee on Professional Conduct and membership on the ASCE Task Committee on the Group Disability Insurance Plan and the Task Committee on Administrative Procedure. He has also been director and president of the Pittsburgh Section.

Thorndike Saville

Thorndike Saville, new Honorary Member of ASCE and consultant to the president of the University of Florida, has an international reputa-

THORNDIKE SAVILLE
Hon. M. ASCE

tion as an engineering educator and specialist in water resources and coastal engineering.

Born in Malden, Mass., he holds bachelor's degrees from Harvard and Dartmouth; a C. E. degree from Dartmouth; master's degrees from Harvard and M.I.T.; and honorary doctorates from Clarkson, Syracuse, and New York University. During World War I, he served as first lieutenant in the Air Service Signal Corps. From 1919 to 1932 he was associate professor and professor of hydraulic and sanitary engineering at the University of North Carolina. Concurrently, he was also chief engineer of the North Carolina Department of Conservation and Development. In 1932, he went to New York University as professor of hydraulic and sanitary engineering, becoming dean of the College of Engineering in 1936. He retired in September 1957, and in March 1958 became director of the Science and Engineering Center study at the University of Florida. Since the completion of the study in 1960, he has been consultant to the president.

Dr. Saville has acted as consultant on hydraulic and sanitary engineering projects during most of his professional career. On leave of absence from time to time, he has directed various engineering activities, including an assignment for the Rockefeller Foundation to establish a Bureau of Sanitary Engineering for the Sanidad Nacional de Venezuela. As executive engineer for the Water Resources Committee of the National Resources Board, he directed the first inventory of U. S. water resources. Among various appointments he has been a member of the U. S. Beach Erosion Board since 1930, and in 1950-51 was chairman of the Engineering Panel on Water Supply for New York City. As consultant to the Long Island State Park Commission since 1936, he has been connected with coastal-erosion and inlet-improvement projects on the Long Island shores.

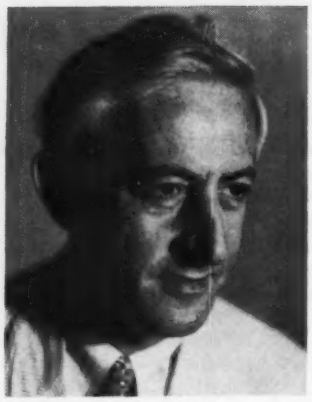
A member of ASCE since 1919, Dr. Saville was Director from 1945 to 1948, and has served on many Society committees. He organized the North Carolina Section in 1922 and was its secretary from 1922 to 1932. He has also been president of the Metropolitan Section.

He has been president of the American Society for Engineering Education, Engineers Joint Council, and Engineers Council for Professional Development. He has represented the U. S. at numerous international conferences, and was president-general of the Fifth International Congress on Coastal Engineering at Grenoble, France, and the Sixth Congress at Gainesville, Fla., and keynote speaker at the Seventh International Congress at the Hague in 1960. He has also been chairman of the EUSEC Committee on Engineering Education. Honors accorded him include the Lamme Medal of ASEE and the 75th Anniversary Medal of the ASME.

Abel Wolman

The professional activities of new Honorary Member Abel Wolman have spanned many fields. A graduate of Johns Hopkins University, he has been in public health work since 1913. With his first employment, as state sanitary engineer, he embarked on a life of service to the State of Maryland. During his employment with the state and in subsequent years, he developed techniques for chlorination of drinking water, established the first sanitary districts in Maryland, and drafted the state's water resources laws. He has also been director of the State Planning Commission and chairman of the advisory council of the Maryland State Roads Commission.

Concurrently with his work for the state, he has served the City of Baltimore in engineering, fiscal, and administrative matters relating to water supply, sewerage, mass transportation, city planning, and redevelopment. His outstanding service to the state and city led early in his career to calls from the Federal Government. As chairman of the Water Resources Board, he had a hand in planning Federal water resources activities in the early 1930's. Water resources development and conservation have remained one of his primary interests. He has served the first Hoover Commission, the EJC National Water Policy Panel, and the present Senate Select Committee. Through the years he has continued as consultant to the Tennessee Valley Authority and the Department of the Interior.



ABEL WOLMAN
Hon. M. ASCE

During World War II he was asked by the National Research Council to help it improve sanitary engineering and environmental health in the military services. This work led, in turn, to his direct employment as consultant to the Department of Defense and to the various branches of the military services. All these activities continue. Professor Wolman was the first sanitary engineering consultant to the Atomic Energy Commission, and he has been a member of the Advisory Committee on Reactor Safeguards almost since its beginning.

When the United Nations was organized, Professor Wolman was chosen to assist the Surgeon General of the U. S. Public Health Service in negotiations that established the World Health Organization. Since then he has served the World Health Organization and the International Cooperation Administration.

His career as a teacher began in 1921, with appointment as lecturer in the Johns Hopkins School of Hygiene and Public Health. In 1937 he became professor of sanitary engineering in both the School of Public Health and the Engineering School. Through the years he has lectured at Harvard, Princeton, Chicago, Southern California, and Illinois.

His professional society activities have also been extensive. He edited the Journal of the American Water Works Association for eighteen years, and was president of that association. He is the only engineer who has been president of the American Public Health Association, and for a period he also edited the Association's Journal. He has served on numerous ASCE committees and boards, and has contributed many articles to Society publications.

ASCE Prizes to Be Awarded During Convention

In keeping with a long-time tradition, the Society will once again present prizes and awards during the Annual Convention—most of them for especially distinguished Transactions papers. Though the majority of the awards honor papers appearing in Volume 125 (1960) of Transactions, several of them are given on recommendation of the Technical Divisions for contributing to the advancement of the profession. Another exception is the Construction Engineering Prize, which traditionally goes to the author of an especially important CIVIL ENGINEERING paper.

As usual, prize-giving day will be Wednesday morning, October 18, during the Annual Convention, which will be back in New York this year.

Norman Medal

A University of Minnesota team collaborated on the paper, entitled "Self-Aerated Flow in Open Channels," which receives the Norman Medal, oldest and most distinguished of the Society's awards. They are **Lorenz G. Straub,** F. ASCE, head of the university's department of civil engineering, and **Alvin G. Anderson,** professor of hydromechanics. **Dr. Straub** was the first (1927-1929) ASCE Freeman Traveling Fellow in Europe for the study of hydraulic engineering. He has served as hydraulic consultant and member of engineering boards for many large river and power development programs, both in the United States and abroad. At the University of Minnesota he originated and developed the St. Anthony Falls Hydraulic Laboratory and continues as director of it. **Dr. Anderson** has been associated with the St. Anthony Falls Hydraulic Laboratory since 1945. His work includes teaching hydraulic engineering and conducting various research projects undertaken by the Laboratory. In 1950 he earned a Ph.D. degree from the university. He is the author of numerous works in the field of sediment transport.

J. James R. Croes Medal

This year the J. James R. Croes Medal, second of the Society's awards in point of distinction, goes to **George Winter,** F. ASCE, for his paper, "Lateral Bracing of Columns and Beams." Dr. Winter has been professor and head of the structural engineering department at Cornell University since 1948. A native of Austria, he had eight years of design and consulting work there before coming to this country and to Cornell in 1938. He received his doctorate in 1940 and then began teaching in the structural engineering department. He was visiting professor at California Institute of Technology in 1950 and at the University of Liege (Belgium) in 1957. He is author of more than fifty research papers and holder of the Society's Moisseiff Award.

Thomas Fitch Rowland Prize

There were three collaborators on the paper, "Clay Strength Increase Caused by Repeated Loading," which has been awarded the Thomas Fitch Rowland Prize. They are **H. Bolton Seed,** M. ASCE, **Robert L. McNeill,** A.M. ASCE, and **Jacques de Guenin.** Since 1950 **Dr. Seed** has been on the staff of the University of California, where he is now professor of civil engineering. He also serves as a consultant to Woodward, Clyde, Sherard & Associates, soil and foundation engineers, and numerous other organizations. Honors accorded him include the Society's Middlebrooks Prize and the J. James R. Croes Medal. Currently, Dr. Seed is secretary of the executive committee of the ASCE Soil Mechanics and Foundations Division. **Mr. McNeill** is supervising civil engineer at the Shock Tube Laboratory at the University of New Mexico, while on leave from San Jose (Calif.) State College, where he taught from 1958 to 1961. From 1956 to 1958 he was staff engineer for Woodward, Clyde, Sherard and Associates. A graduate of the University of California, Berkeley, he received the Clement T. Wiskocil Award to the outstanding graduate. A graduate of the Ecole Nationale Superieure des Mines de Paris, **Mr. de Guenin** received his master's degree from the University of California. After work as a research engineer in soil mechanics with Professor Seed, he returned to France. He is now in the field of Operations Research and Automatic Computing with Esso Standard, S.A.F., French affiliate of the Standard Oil Company of New Jersey, and is lecturing on search theory at the Joint Military Operations Research Training Center.

James Laurie Prize

J. Barry Cooke, F. ASCE is the recipient of the James Laurie Prize for his paper entitled, "Rockfill Dams: Wishon and Courtright Concrete Face Dams." Mr. Cooke is a previous (1960) winner of the Rickey Medal and co-winner this year of the Thomas A.

LORENZ G. STRAUB

ALVIN G. ANDERSON

Co-winners of Norman Medal

GEORGE WINTER

J. James R. Croes Medal

H. BOLTON SEED

ROBERT L. McNEILL

JACQUES DE GUENIN

Co-winners of Thomas Fitch Rowland Prize

Middlebrooks Award. Since his graduation from the University of California in 1939, he has been with the Pacific Gas and Electric Company. He has been connected with the engineering development and operation of many of the company's hydroelectric developments.

Arthur M. Wellington Prize

T. William Lambe, F. ASCE, professor and head of civil engineering at Massachusetts Institute of Technology, is the recipient of the Arthur M. Wellington Prize for his paper on "Compacted Clay: Engineering Behavior." On the M.I.T. staff since 1945, Professor Lambe has also been consultant in soil engineering to such groups as the Army Corps of Engineers, the governments of Jamaica and Iraq, the Union Carbide Company, and the Port of New York Authority. Professor Lambe won the Society's Collingwood Prize in 1951 and the Desmond Fitzgerald Medal of the Boston Society of Civil Engineers in both 1954 and 1956. He is author of a textbook and 44 papers in the soil mechanics field.

Collingwood Prize

The Collingwood Prize, which is restricted to younger members, goes to **Sidney A. Guralnick,** M. ASCE, for a paper on "Strength of Reinforced Concrete Beams." A graduate of Drexel Institute, he earned his M.S. and Ph.D. degrees at Cornell University in 1955 and 1958. His present prize-winning paper is a condensation of his Ph.D. thesis. From 1956 to 1958 he was manager of the Structural Research Laboratory at Cornell. Since 1958 he has been assistant professor of civil engineering at Illinois Institute of Technology and, beginning this September, becomes associate professor. During the past year, under a cooperative arrangement between the Institute and the Portland Cement Association, he has been principal investigator in a research program on flat-plate construction conducted at the PCA Research and Development Laboratories at Skokie.

Construction Engineering Prize

Gail Knight, a New York City tunnel expert, is the winner of the Construction Engineering Prize, which is given for a specially important CIVIL ENGINEERING article. He was assistant project engineer for West Delaware Tunnel Constructors on construction of the West Delaware Tunnel for the New York City water supply, described in his prize-winning article in the December 1960 issue of CIVIL ENGINEERING. As project manager for Johnson, Drake & Piper, he is currently on the Intake Structure Project for the Board of Water Supply at Cannonsville, N. Y.; a conveyor tunnel and shaft at Ravena, N. Y., for the Atlantic Cement Company; and a section of the Sixth Avenue Subway tunnel in New York.

Rudolph Hering Medal

The Rudolph Hering Medal—established in 1924 by the Sanitary Engineering Division—is given for a

J. BARRY COOKE

James Laurie Prize

T. WILLIAM LAMBE

Arthur M. Wellington Prize

SIDNEY A. GURALNICK

Collingwood Prize

A. L. THOLIN
Co-winner of Rudolph Hering Medal

HUNTER ROUSE

S. NAGARATNAM
Co-winners of Karl Emil Hilgard Hydraulic Prize

paper that best advances the sanitary branch of the profession. This year it goes to two Chicago engineers—**A. L. Tholin,** F. ASCE, and **Clint J. Keifer,** M. ASCE, for their paper on "Hydrology of Urban Runoff." **Mr. Tholin** was in charge of the Sewer Planning Division of the Bureau of Sewers from 1946 to 1957, and administrative engineer of the Department of Public Works from 1958 to 1960. Since January 1961 he has been engineer of public works. **Mr. Keifer** is senior sewer design engineer for the Chicago Bureau of Engineering. He has been responsible for the design of over $100 million worth of sewer improvements for the city.

Karl Emil Hilgard Hydraulic Prize

The Karl Emil Hilgard Prize, which is given biennially for a superior paper dealing with a problem of flowing water, this year honors a paper of joint authorship entitled "Turbulence Characteristics of the Hydraulic Jump." The authors are **Hunter Rouse,** F. ASCE, **Tien To Siao,** and **S. Nagaratnam,** A.M. ASCE. **Dr. Rouse,** holder of degrees from Massachusetts Institute of Technology, the Karlsruhe Technische Hochschule, and the University of Paris, has been M.I.T. Traveling Fellow in Hydraulics and Fulbright Research Scholar and Exchange Professor. He has been professor of fluid mechanics at the State University of Iowa since 1939 and director of the Iowa Institute of Hydraulic Research since 1944. Since **Mr. Nagaratnam's** return to India, in 1959, he has been working in the field of hydraulic machinery—pumps and turbines. While he was in the United States he was design engineer for the Chicago firm of Wilson, Roberts, Andros & Noll.

Thomas A. Middlebrooks Award

J. Barry Cooke, this year's winner of the James Laurie Prize, is doubly honored by being co-winner—with **I. C. Steele**—of the Thomas A. Middlebrooks Award. Their prize-winning paper is entitled "Salt Springs and Lower Bear River Concrete Face Dams." After graduating from the University of California in 1909, **Mr. Steele** became connected with the Pacific Gas and Electric Company. He was made chief engineer of the company in 1944 and vice president and chief engineer in 1947. Since his retirement in 1952 he has been in consulting practice, specializing in the design and construction of rockfill-type dams and hydroelectric projects. In 1955 he received the Honorary Award of the Building Industry Conference Board of San Francisco for his work on dams and steam power plants. He is a past president of the San Francisco Section and a former Director of ASCE.

Moisseiff Award

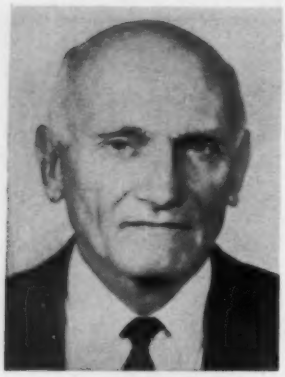
The Moisseiff Award, given for a distinguished paper in the field of structural design, goes this year to **John A. Blume,** F. ASCE, president of the San Francisco consulting civil and structural engineering firm of John A. Blume & Associates. Mr. Blume's firm specializes in earthquake-resistant design, and his prize-winning paper is on the subject, "Structural Dynamics in Earthquake-Resistant Design." He has done seismological engineering for the U. S. Coast and Geodetic Survey and was construction engineer on the San Francisco-Oakland Bay Bridge. Mr. Blume is the author of papers and books, mainly in the field of engineering seismology and structural dynamics, and participated in both the First and Second World Conferences on Earthquake Engineering. He is a two-time winner of the Moisseiff Award.

Rickey Medal

Torald Mundal, F. ASCE, is this year's winner of the Rickey Medal, which is given for a notable contribu-

GAIL KNIGHT
Construction Engineering Prize

I. C. STEELE
Co-winner of Middlebrooks Award



TORALD MUNDAL
Rickey Medal

DARYL B. SIMONS

EVERETT V. RICHARDSON

Co-winners of J. C. Stevens Award

tion to hydroelectric engineering. His prize-winning paper is entitled "Rockfill Dams: Brownlee Sloping Core Dam." Since 1948 Mr. Mundal has been connected with the International Engineering Company, San Francisco, first as chief design engineer, and, since 1952, as chief engineer. During this period he has been responsible for design and, in some cases, supervision of construction of a number of hydroelectric and water-resource projects in the Western U. S., Brazil, India, Peru, and Korea. In his earlier career he designed hydroelectric and steam power plants—including the Beauharnois Project on the St. Lawrence—for the Duke Power Company and multiple-purpose projects for the Tennessee Valley Authority.

J. C. Stevens Award

Two research engineers with the U. S. Geological Survey share the J. C. Stevens Award for their discussion of the paper entitled, "Resistance Properties of Sediment-Laden Streams." They are **Daryl B. Simons,** M. ASCE, project chief, and **Everett V. Richardson,** research engineer. From 1948 to 1957 **Dr. Simons** was professor of civil engineering at the University of Wyoming. In the latter year he received his doctorate from Colorado State University, where he remained as project engineer for the Geological Survey. His research program there has resulted in several publications dealing with resistance to flow and sediment transport in alluvial channels. He is also co-author of a recent text, *Fluid Mechanics for Engineers.* Dr. Simons is a member of the Task Committee on Bank Stabilization of the Waterways and Harbors Division and of the Publications Committee of the Irrigation and Drainage Division. As a hydraulic engineer for the U. S. Geological Survey since 1949, **Mr. Richardson** has conducted sediment investigations in Wyoming, Iowa, and Colorado. He is currently stationed at Colorado State University, where he is participating in the laboratory and field investigation of sediment transport in alluvial channels headed by Dr. Simons. He is author of numerous papers on sedimentation, hydraulics and hydrology.

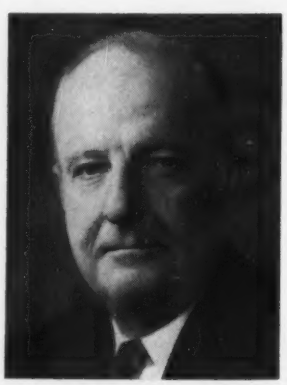
JOHN A. BLUME
Moisseiff Award

Theodore von Karman Medal

R. D. Mindlin, M. ASCE, professor of civil engineering at Columbia University, has been awarded the Theodore von Karman Medal "in recognition of distinguished achievement in engineering mechanics." On the Columbia staff since 1932, Dr. Mindlin recently received a "Great Teacher Award" from the Society of Older Graduates of Columbia. Currently Dr. Mindlin is serving on the National Aeronautics and Space Administration's new Research Advisory Committee on Structural Dynamics.

Ernest E. Howard Award

The Ernest E. Howard award goes to **Herschel H. Allen.** F. ASCE, "for the definite contributions he has made to the advancement of structural engineering, with special reference to the 'Potomac-type' bridge piers which he developed." Connected with the J. E. Greiner Company, of Baltimore, Md., since 1919, Mr. Allen has been a senior partner in the company since 1942. His many projects include the Chesapeake Bay Bridge connecting the Eastern and Western shores of Maryland; the Patapsco River Tunnel in Baltimore; the Pennsylvania Turnpike; Friendship International Airport, Baltimore; and the Ohio Turnpike (Pennsylvania-to-Ohio section). He is the author of numerous technical papers and reports on the strength and carrying-capacity of bridges.



HERSCHEL H. ALLEN
Ernest E. Howard Award

Tellers Canvass Final Ballot for 1962 Officers

New York 17, N.Y.
September 15, 1961

To the 1961 Annual Meeting
American Society of Civil Engineers:

The Tellers appointed to count the Election Ballot for Officers of the Society report as follows:

For President
(Term October 1961-October 1962)

G. Brooks Earnest	11,627
Scattering	12
Void	4

For Vice President—Zone I
(Term October 1961-October 1963)

Carey H. Brown	2,164
Scattering	14
Void	2

For Vice President—Zone IV
(Term October 1961-October 1963)

Burton G. Dwyre	3,573
Scattering	20
Void	0

For Director—District 1
(Term October 1961-October 1964)

David G. Baillie, Jr.	1,182
Scattering	9
Void	1

For Director—District 3
(Term October 1961-October 1964)

N. A. Christensen	393
Scattering	4
Void	32

For Director—District 5
(Term October 1961-October 1964)

Waldo E. Smith	310
W. Orme Hiltabidle	273
Scattering	3
Void	6

For Director—District 7
(Term October 1961-October 1964)

Charles W. Yoder	712
Scattering	5
Void	1

For Director—District 11
(Term October 1961-October 1964)

Henderson E. McGee	2,069
Scattering	11
Void	0

For Director—District 12
(Term October 1961-October 1964)

Leland J. Walker	703
Scattering	5
Void	0

For Director—District 16
(Term October 1961-October 1964)

Roy M. Green	745
Scattering	5
Void	0

Ballots counted	23,885
Ballot envelopes without signature	91
Dues arrears	312

Respectfully submitted,

RICHARD D. EGAZARIAN, *Chairman*
JOHN D. STALLMAN, *Vice Chairman*

Leon Goodman — Richard C. Miller
Charles W. Griffin, Jr. — Philip Perdichizzi
Albert P. Loriot — *Tellers*

Papers Solicited for Journal of Professional Practice

Members interested in writing and concerned with today's pressing professional problems are urged to contribute to the *Journal of Professional Practice*. Subjects that may (and should) be treated in the Journal include employment conditions, engineering education, guidance of engineers in public practice, registration, unionization, administration of Local Sections, the entire broad topic of engineering unity, and suggestions for making the Society more meaningful to Student Chapters and to younger members. All these possibilities, and many more, should inspire thoughtful members to take pen in hand and get busy. Standards of acceptance for the *Journal of Professional Practice* are identical with those of the Technical Division Journals.

Papers should not be longer than 18,000 words, including tables and illustrations. Copies should be submitted in triplicate (an original and two carbons) to the Technical Publications Department at Society headquarters. A guide to ASCE publications is available to prospective authors on request, and the staff is always ready to answer any questions.

Published papers remain open to discussion by the membership for six months after publication. The author then answers any discussion elicited in a closing discussion. At the end of the year the papers are included in Part V of *Transactions*, where they are indexed and cross-indexed in the same manner as papers in the journals of the Technical Divisions.

Members may now place a standing order for copies of the *Journal of Professional Practice*, to be sent as issued. Your account will be charged $1.50 for each Journal. This arrangement will in no way interfere with the two free Technical Division Journals to which members are entitled.

New Daniel Mead Prize Competition Is Open

Associate Members of the Society who have not passed their 32nd birthday, and Student Chapter Members in good standing, again have an opportunity to compete for the two national prizes endowed in 1939 to commemorate the life and work of Daniel W. Mead, Past-President and Honorary Member of the Society.

The awards are made on the basis of papers on any professional civil engineering subject, but preference is given to outstanding papers on professional ethics. Contestants have three chances to win: first, at the local level; second, as one of the best authors in his Zone; and third, at national level. The paper must first be presented before a Local Section or Local Section Conference or a Student Chapter Conference. The best paper thus presented is transmitted to the Zone Vice President, whose committee determines the best paper in his Zone. The Society awards one of the parts of the current *Transactions* to each winner in the Zone contest. The Zone contest winners are then entered in the national contest which is judged, respectively, by the Committee on Student Chapters and the Committee on Younger Members. The Zone winner of the Student Award receives a single part of the annual *Transactions*, and the Zone winner of the Associate Member award receives all the parts of the current volume of *Transactions*.

In the Final (national) contest, the Student winner receives $50 and the Associate Member winner $100. Both prize-winning papers are published in the *Journal of Professional Practice*.

For more details consult the rules of award in the current Official Register, or write to the Executive Secretary at Society headquarters.

ASCE Research Fellow To Start His Studies

This fall Robert B. Anderson, A.M. ASCE, an instructor in civil engineering at Carnegie Institute of Technology, will start work as ASCE Research Fellow for the 1961-1962 academic

year. Mr. Anderson will receive a grant of $5,000 from the ASCE for research towards his Ph.D. degree. The fellowship winner was chosen from young civil engineers all over the country.

Under the terms of the grant, he will devote full time during the academic year to his research in the field of fracture mechanics. His research will be conducted under the direction of Prof. James P. Romualdi.

A native of Pittsburgh, Mr. Anderson received his B.S. degree from Carnegie Tech in 1958 and his M.S. in 1960. In 1958-1959, he served as a teaching assistant and in 1959-1960 was a research assistant in the department of civil engineering.

ASCE ENGINEERING SALARY INDEX

Prepared Semiannually

Consulting Firms

CITY	CURRENT	PREVIOUS
Atlanta	1.38	1.38
Baltimore	1.16	1.14
Boston	1.26	1.23
Chicago	1.44	1.50
Denver	1.32	1.25
Houston	1.31	1.26
Kansas City, Mo.	1.26	1.19
Los Angeles	1.36	1.35
Miami	1.38	1.38
New Orleans	1.25	1.22
New York	1.30	1.29
Pittsburgh	1.11	1.07
Portland, Oregon	1.31	1.28
San Francisco	1.38	1.35
Seattle	1.13	1.13

Highway Departments

REGION	CURRENT	PREVIOUS
I, New England	1.03	1.03
II, Mid Atlantic	1.18	1.15
III, Mid West	1.32	1.26
IV, South	1.12	1.12
V, West	1.16	1.13
VI, Far West	1.20	1.16

Sole purpose of this Index is to show salary trends. It is not a recommended salary scale. Nor is it intended as a precise measure of salary changes. The Index is computed by dividing the current total of base entrance salaries for ASCE Grades I, II and III by an arbitrary base. The base used is $15,930, the total of salaries paid in 1956 for Federal Grades GS5, GS7 and GS9. Index figures are adjusted semiannually and published monthly in CIVIL ENGINEERING. Latest survey was June 30, 1961.

ASCE Membership as of September 11, 1961

Fellows	11,116
Members	17,096
Associate Members	20,417
Affiliate Members	125
Honorary Members	50
Total	48,804
(September 9, 1960	46,794)

Jury Selected For OCEA Award

The Jury of Editors which will select the Outstanding Civil Engineering Achievement of the Year for the 1962 Award has been announced by W. H. Wisely, Executive Secretary.

Eight editors of magazines in the United States make up the jury for the 1962 selection. They are: Robert E. Fischer, Associate Editor, *Architectural Record,* New York City; Waldo G. Bowman, Editor, *Engineering News-Record,* New York City; John M. Server, Jr., Editor, *Southwest Builder and Contractor,* Los Angeles; R. G. Zilly, Editor, *Consulting Engineer,* Saint Joseph, Mich.; R. E. Fuhrman, Editor, *Journal of Water Pollution Control Federation,* Washington, D. C.; Harold J. McKeever, Editor-in-Chief, *Roads and Streets,* Chicago; James I. Ballard, President, *Western Construction,* San Francisco; and Hal W. Hunt, Editor, CIVIL ENGINEERING, New York City. Mr. Hunt will serve as chairman of the jury.

Nominations for the competition, judged on the basis of (1) engineering skill, (2) engineering progress, and (3) service to mankind, are made by Directors of the Society. Deadline for the receipt of nominations at ASCE headquarters for the 1962 award will be December 1, 1961.

This will be the third year of the OCEA competition. The first award, in 1960, was made to the St. Lawrence Power and Seaway Project, and the 1961 award went to New York International Airport. Twelve projects were nominated for the 1960 competition, and 11 for the 1961 competition.

First Meeting in UEC

ASCE Committee on Division Activities is first Society group to meet in the new UEC. Shown in the Chi Epsilon Conference Room are (seated, in usual order) Charles Britzius; Chairman Charles B. Molineaux; Vice Chairman William J. Hedley; and ASCE Director Samuel S. Baxter. Standing, in same order, are ASCE Directors C. Merrill Barber, Thomas J. Fratar, Daniel B. Ventres, Elmer K. Timby, and Thomas M. Niles.

EJC Officials Abroad For Council Interests

In the interest of improving U.S. relations with foreign countries through professional understanding two Engineers Joint Council officials went abroad in the late summer to meet with international professional groups.

George Brown, chairman of the EJC Committee on International Relations, is combining a business trip to Latin America with consultations with officials of the Pan American Federation of Engineering Societies (UPADI) concerning EJC's international program. In Puerto Rico he will meet with officials of local engineering societies to discuss arrangements for the 1962 UPADI Convention to be held there. In Montevideo, Uruguay, he will discuss with the UPADI board of directors the possibility of developing projects of mutual interest to the Americas in engineering, sanitation, transportation, and power.

On a similar mission in Europe, Josef Wischeidt, Jr., secretary of the Committee on International Relations, will meet with UNESCO officials in Paris to discuss EJC cooperation with that organization. In his capacity as executive secretary of the U.S. Committee of the International Association for the Exchange of Students for Technical Experience (IAESTE), Mr. Wischeidt will also be the guest of the German National IAESTE Committee on a tour of German industries in which American students are currently training.

NSPE Reports Salary Survey

From the standpoint of salary, the American professional engineer continues to gain increased recognition for his work. This is the conclusion drawn from a survey of over 24,000 engineers, conducted and published by the National Society of Professional Engineers.

Median income for the engineers responding to the survey reached a new high of $10,660—up by 6.6 percent from a similar survey taken in 1958. Further, this increase is reflected at almost all salary levels.

For the young engineer as well as the average engineer, the salary picture is likewise improved. In tabulation by year of entry into the profession there is a steady increase in starting salaries from 1952, representing a rise of nearly 25 percent over the eight-year period.

ASCE CONVENTIONS

ANNUAL CONVENTION

New York, N. Y.
Hotel Statler
October 16-20, 1961

HOUSTON CONVENTION

Houston, Tex.
Hotel Shamrock, Hilton
February 19-23, 1962

OMAHA CONVENTION

Omaha, Nebr.
Hotel Sheraton-Frontenelle
May 14-18, 1962

DISTRICT CONFERENCES

DISTRICT 3 COUNCIL

Syracuse, N.Y.
November 18, 1961

PACIFIC SOUTHWEST COUNCIL

San Diego, Calif.
El Cortez Hotel
April 5-7, 1962

PACIFIC NORTHWEST COUNCIL

Seattle, Wash.
Olympic Hotel
April 20 and 21, 1962

TECHNICAL DIVISION MEETINGS

SYMPOSIUM ON CONSERVATION OF AIR RESOURCES

New York, N. Y.
New York University
November 17, 1961
Sponsored by
Sanitary Engineering Division
Research Council on Air Resources Engineering

ENGINEERING MECHANICS DIVISION CONFERENCE

Austin, Tex.
University of Texas
April 26 and 27, 1962
Sponsored by
Engineering Mechanics Division

1960 Alfred Noble Prize Presented in Los Angeles

Belated presentation of last year's Alfred Noble Prize is made to Ronald T. McLaughlin, Jr., A.M. ASCE, by Samuel B. Nelson, president of the Los Angeles Section, while L. Harrison Newport (left) looks on. Presentation of the award could not be made earlier because Mr. McLaughlin has been in Bangkok, Thailand, as a sanitary engineer with the World Health Organization. At the request of the Society, the Los Angeles Section arranged a meeting in his honor on his return, recently, to the U.S. The Alfred Noble Prize—a joint award of the four original Founder Societies and the Western Society of Engineers—is given annually to a young member of one of the participating societies for a technical paper of exceptional merit.

NOTES FROM THE LOCAL SECTIONS

(Copy for these columns must be received by the fifth of the month preceding date of publication)

Present at the first meeting of the recently-formed Lansing-Jackson Branch of the Michigan Section were Lytle G. Miller, Branch vice president; Charles Hunt, vice president of the Fargo Engineering Co., speaker; F. Spencer Weber, Branch president; and Prof. Robert Harris, president of the Michigan Section.

LOCAL SECTIONS MEETINGS

Georgia—Evening meeting with panel on "Present and Future Trends in Civil Engineering Education" on November 3.

Intermountain—Regular monthly meetings the fourth Friday of each month.

Massachusetts—Social hour and dinner meeting on November 20, at 5:30 p.m.

Metropolitan—Regular monthly meeting in the United Engineering Center on the United Nations Plaza, New York, November 15, at 7:00.

Sacramento—Weekly luncheon meetings at the Elks Temple every Tuesday, at 12 noon.

St. Louis—Regular monthly luncheon meetings at the York Hotel on the fourth Monday of each month, at 12:15 p.m.

Tennessee Valley—Fall meeting at the University of Tennessee, Knoxville, November 3 and 4.

Texas—Fall meeting at the Driskill Hotel, Austin, October 5-7.

Wisconsin—Symposium on "Metropolitan Transportation" at the Milwaukee, Inn, Milwaukee, on November 9.

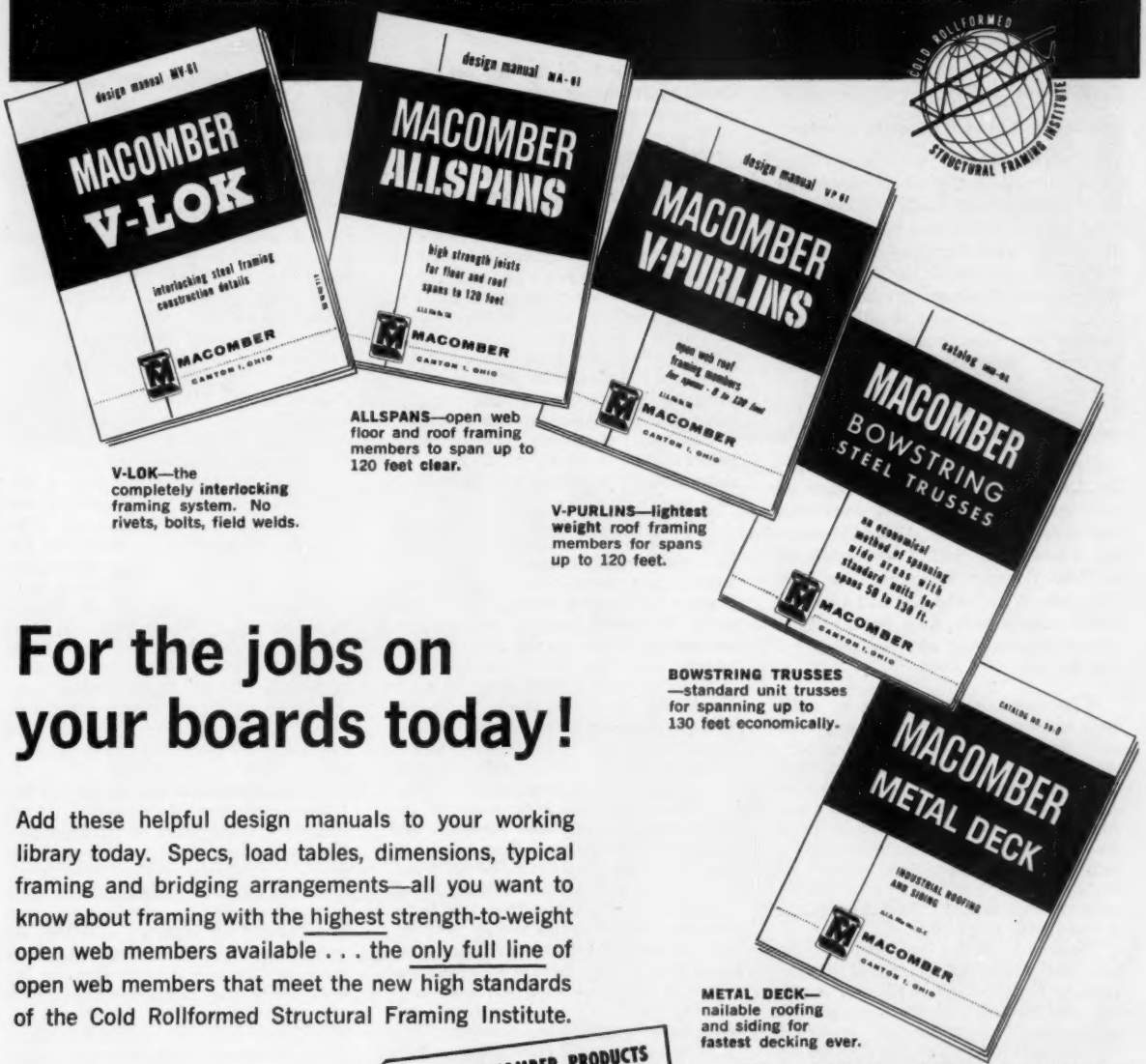
During August the Central Ohio Section made an inspection trip to the Greenup Locks and Dam in the Ohio River as guests of the Corps of Engineers. In the back row in usual order are William McCraw, Corps of Engineers; William Borghese, U.S. Geological Survey; E. A. Rauber, Portland Cement Association; Henry Overman, Ohio Highway Department; Harry Hawley, Ohio Highway Department; and Stanley Belonos, Columbia Gas System Service Corporation. While the front row, left to right, shows Henry McCoy, Jr., Massman Construction Company; William Strasser, Ohio Highway Department; Harold Brooks, U.S. Geological Survey; John Van Dyke, Columbia Gas System Service Corporation; Charles Lentz, Corps of Engineers; and John Griffith, Ohio Highway Department.

The **Alabama Section,** which held regular meetings throughout the summer, reports that its apprehension about attendance appears to have been unwarranted. A case in point was one of the last meetings of the season. The report is that the attendance was fine, the technical program very good, and the fellowship and socials far above average. Early in the meeting Don Mattern, Vice President, Zone II, outlined and explained recent actions taken by the National Board of Directors, such as changes in the ASCE Code of Ethics and changes in the composition of the national meetings. At the conclusion, a dance was held, with the very youngest to the oldest members participating. All in all summer meetings were an outstanding success.

Another Section which held meetings during the summer months was the **Massachusetts Section.** Among the many and varied speakers who participated in these luncheon meetings were Dr. Albert G. H. Dietz, professor of structural engineering at the Massachusetts Institute of Technology who gave a talk on "New Developments in the Use of Plastics in Construction," illustrated by slides of the experimental plastic house in California and the American Building at the Moscow Exposition of last year, and George C. Taumpouras, associate commissioner of the Massachusetts Department of Public Works, whose brief talk on the function of the Department included a description of current work on the interstate system and progress in research being conducted in cooperation with M.I.T.

The **Wisconsin Section** is sponsoring a "Symposium on Metropolitan Transportation" in Milwaukee on November 9. The speakers, all experts in their particular fields, include Sanford Farness, executive planning director of the Southeastern Wisconsin Regional Planning Commission; J. Douglas Carroll, Jr., director of the Chicago Area Transportation Study; Donald C. Hyde, general manager of the Cleveland Transit System and vice president of the Institute for Rapid Transit; George W. Anderson, executive vice president of the American Transit Association; Jay Medford, regional planning and research engineer of the Bureau of Public Roads; and Alger F. Malo, director of the Department of Streets and Traffic, City of Detroit. The $6.00 registration fee will also include a noon luncheon.

COMPLETE READING ON ECONOMICAL HIGH-STRENGTH OPEN WEB FRAMING



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Committee on Younger Member Publications

Walter D. Linzing, Chairman; 4751 No. Paulina, Chicago 40, Ill.

Zone I	Zone II	Zone III	Zone IV
Donald Kowtko 289 Foxhill Road Denville, N. J.	Russel C. Jones 2020 Delaware Avenue Pittsburgh 18, Pa.	William R. Walker 4600 Franklin Ave. Western Springs, Ill.	Judd Hull 6000 S. Boyle Ave. Vernon, Calif.

This month's editor is Judd R. Hull, Zone IV committeeman.

Become an "active" Associate Member

Across the nation 1962 officers of the Local Sections, Technical Divisions, and Local Branches are holding meetings to select committeemen and map their programs and goals for the coming year. These dedicated officers will welcome the participation of younger members in service on committees and in other ways. Contact your Local Section secretary and find your "berth on the 1962 ASCE team."

Sales engineering is a rewarding field

Clyde M. Wood, F. ASCE, a consultant for Automatic Sprinkler Corporation of America, has written to this committee answering my challenge, "Sales Engineering—a Rewarding Field?," which appeared in "The Younger Viewpoint" for May 1961. Mr. Wood, who has had some 45 years' experience in sales engineering—"direct, promotional and managerial"—says in part:

"Choosing sales engineering as a life work involves more than a choice between civil, mechanical, and electrical engineering. It is also more complicated than choosing between design, construction, and research engineering. There are many engineers and even more salesmen. There are comparatively few sales engineers, because fewer men can be developed in both engineering and selling, and therefore are more difficult to find. The sales engineer is essentially a specialist.

"So it is vital that you first consider your abilities and the demands of the sales engineering profession. A Klein or similar test, and/or sessions with a psychologist might convince you that you are, or are not, qualified for sales engineering. Do you like to go out, move around and meet new people? Or do you prefer to remain in one place and have people come to you? Do you like a change of pace?"

Mr. Wood defines creative sales engineering as "broadly" divided into three types: direct sales engineering, promotional sales engineering, and managerial sales engineering.

The point in question is the "rewards" of sales engineering, and on that question he outlines the following:

"You are on your own. To a large extent you decide whom to see next and what to do for him after you get there. This is a privilege not enjoyed by the average engineer.

"You are on the move. Whether your territory is small or large, you get around. There's no feeling of being chained to a desk, drawing board or construction job.

"Variety in your work and in the people you meet. The contrast between engineering work and sales work provides some of your greatest sources of satisfaction. When design and estimating become irksome, you can call on a prospect. Interviewing a new prospect is one of the greatest adventures in commercial life.

"You are working with people of higher than average intelligence and position. Your contracts generally run into substantial sums of money, and only the higher officials in a commercial or professional firm are entrusted with negotiating such contracts.

"Creative sales engineering. In both engineering and selling there is opportunity for creative work. If the buyer shows no interest, it is because he believes your product or equipment does not fit his needs. By careful study of *his problem,* you may find that a permissible variation in your apparatus will fill his need.

"Satisfaction in serving your customer. Knowledge of the customer's needs and of your product earns his interest and respect. The use of your product marks an improvement in his business and he knows you were responsible.

"Opportunity to promote progress. Improvement in equipment, methods, and materials is continuous. The sales engineer is, by the very nature of his thinking, training and contacts with the buyer, in preferred position to earn a share in the progress effected by the use of these improvements. Since resistance to improvement is proverbial, there is no greater satisfaction than in having a part in the engineering application and sale of improved equipment, methods and materials.

"Opportunity to be known in your local community and farther. If the sales engineer has a desire for public recognition, the nature of his work offers the opportunity to gratify it. He can accomplish this without spending the years necessary to achieve management status.

"Stability of the sales engineer's position. The sales engineer who knows his product and his territory, and who has a record of producing sales at a profit—is in an enviable position. During hard times he is the last to be let out and the first to be brought back. Being the prime mover of business, he must be kept on the job.

"Earnings. Because of the comparative scarcity of sales engineers, their incomes are rarely if ever published as are those of engineers and salesmen. The sales engineer performs the dual function of engineering and selling, including the exacting demands of both; his work is more difficult and for this reason more time is required for his development. Therefore it is both logical and true that after he has demonstrated his ability by closing profitable contracts against competition, the sales engineer earns more money than the engineer or salesman of the same age and experience."

A new name for engineers?

James M. Abernathey, A.M. ASCE, of Houston, Tex., sends in the following letter regarding a previous article in CIVIL ENGINEERING:

"In the March Younger Viewpoint, Swen Johnson expresses the belief that a new name for the engineering profession might eliminate the confusion that he sees surrounding the term "Engineer." He suggests the term "Dialectic," and then goes on to state that this would make possible a reorganization of the profession by bringing all the existing societies into one.

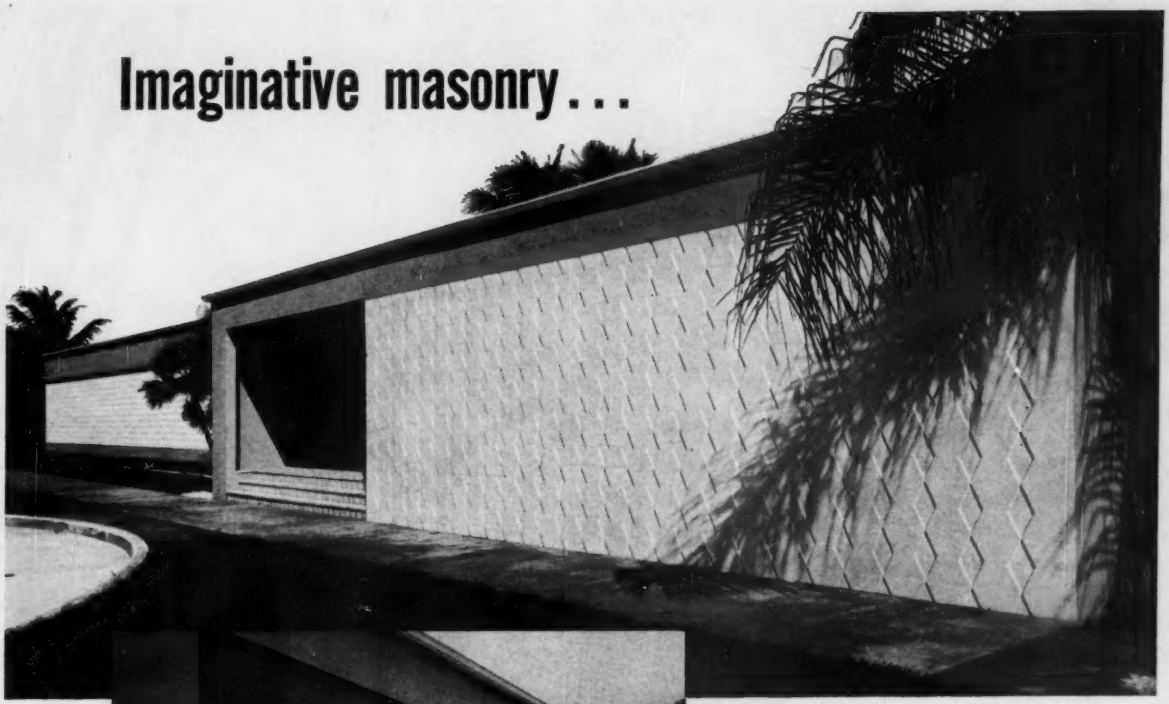
"I see in Mr. Johnson's argument one central theme, and this is a plea for order—an orderly, tightly organized society with one central governing agency. . . .

"I think we can see the flaw in Mr. Johnson's reasoning by examining our own organization. Although, some of us are fairly specialized, we are all Civil Engineers. The specific identification as a structural engineer or a foundation engineer is de-emphasized, and the binding force—the glue, if you please, that holds us all together—is not the fact that we are just Engineers, but that we are Civil Engineers. It is this same binding force that unites us in our struggle for professional relationships—our identity as Civil Engineers, as differentiated from Mechanical or Electrical Engineers.

"In an organization such as the one Mr. Johnson envisions, the identity of Civil Engineers would likewise be de-emphasized in the face of the single term, Engineer (or Dialectic, or what have you). Since the various branches of the engineering profession are so widely divergent by nature of the types of work they do and, indeed, in the relative value they place on such aspects of professional life as private practice (a traditional aspiration of most Civil Engineers), the effect of this de-emphasis on identity would, I think, be to the detriment of the profession rather than to its advantage. Too many people these days are mistaking "unity" for "uniformity"; and the regimentation that must, by definition, go along with uniformity (the elimination of difference) is the ingredient that would emasculate and neutralize our engineering profession.

"The answer, then, is to continue to work as we have—united in the fact that we are Engineers . . . but, also proud to maintain our identity and integrity as Civil Engineers. Let each branch diligently pursue our common professional goals, but consistent with its own values and in tune with its own traditions and distinguishing features. This will make us stronger."

Imaginative masonry...



Meekins, Inc., manufacturers of concrete masonry units, had this new headquarters designed to show the architectural possibilities of their products. Lehigh Mortar Cement was used to lay up the units.

Precast concrete risers, floor units and hand rail were used in this attractive entrance. Prestressed double tee units for the roof made this an all-concrete building.

• Inside and out, this attractive commercial building is all concrete. The designer blended a variety of masonry units—such as shado-wal, solar screen, ordinary block—into an interesting, functional structure.

More and more, architects and builders are developing the exciting design possibilities of modern concrete masonry. Today's array of strong, light units in myriad sizes, shapes and textures serves both structurally and decoratively—in all types of buildings.

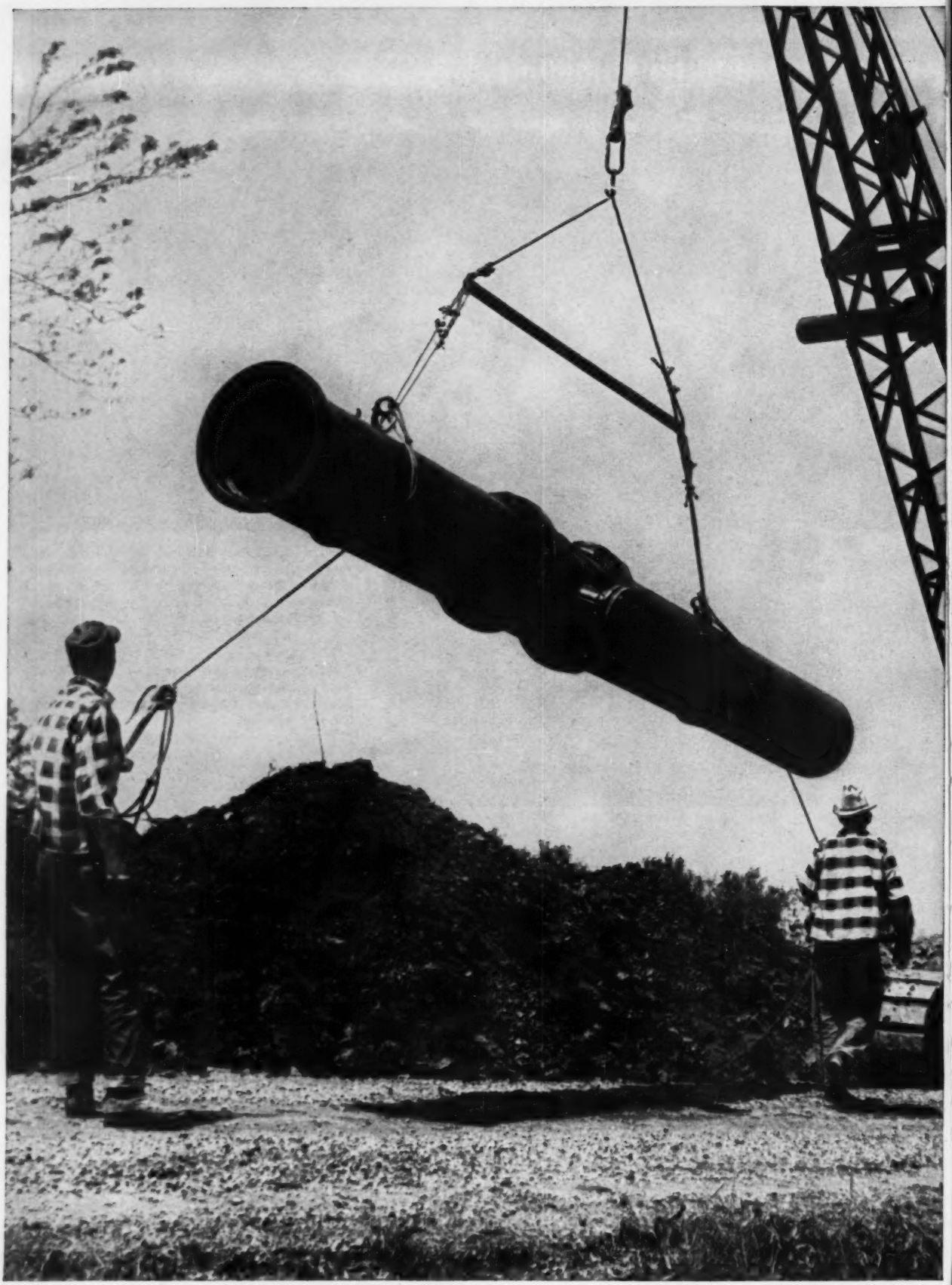
And remember, when you build with concrete masonry, use Lehigh Mortar Cement. Its plasticity and workability make it easier for masons to do a good job — help assure clean, strong, weather-tight walls.

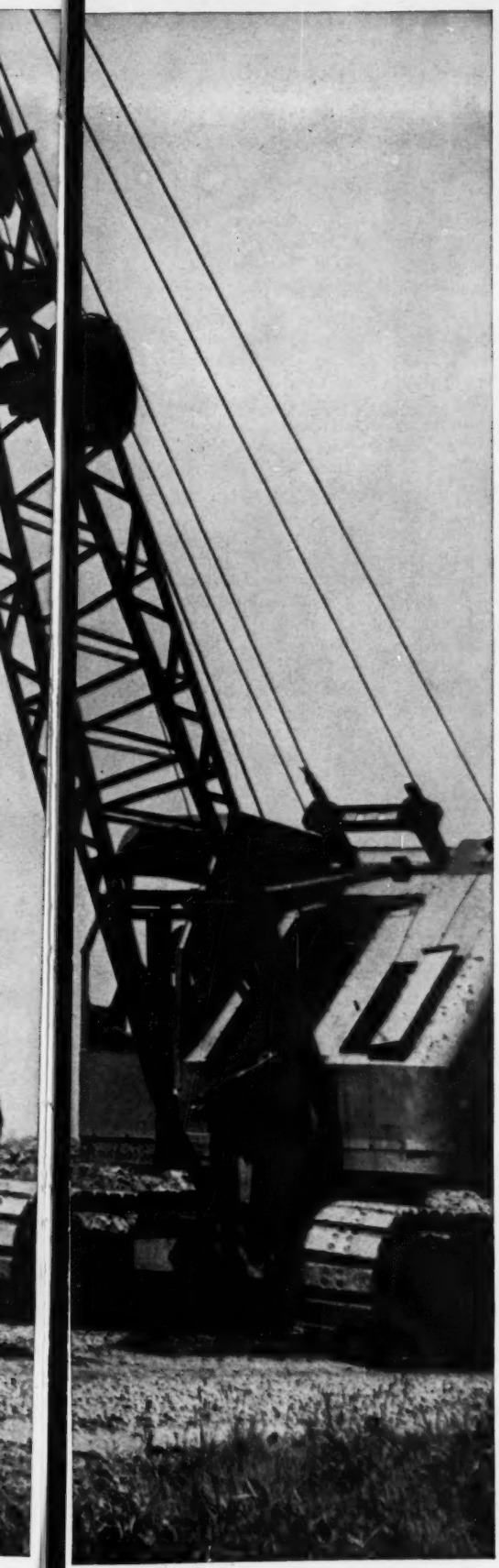
Lehigh Portland Cement Company, Allentown, Pa.

Screen block gives needed protection from sun's glare. At night screen is back-lighted with colored lights. Lehigh Early Strength Cement was used in the manufacture of all units.

LEHIGH CEMENTS

Owner: Meekins, Inc., Hollywood, Fla.
Architect: Kenneth J. Spry, Hollywood, Fla.
Contractor: Ralph S. McComiskey, Hollywood, Fla.





PIPE THAT SHOULDERS A HEAVY LOAD WITHOUT SHOWING ITS AGE

Recently installed in a town in Illinois, this cast iron pipe water supply system now serves a large industrial area.

Besides the internal pressure of supplying the heavy daily demand, there is a heavy load overhead, too. The industrial area is a packaging and distribution center. Large numbers of fully loaded rail cars and trucks come and go every day.

As far as the cast iron pipe is concerned, this is all in a day's work.

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CAST IRON PIPE

THE MARK OF THE 100-YEAR PIPE

BY-LINE WASHINGTON . . . . .

Civil engineers got a courteous bow in provisions of the newly passed **"Foreign Assistance Act of 1961"** (Public Law 195), which sets up funds for the Development Loan Fund and other programs. But the language was a far cry from flat assurance that an engineer would head up the DLF, despite suggestions from professional organizations and some expressions of gratification from them.

A House-passed bill on the subject had provided something a little more direct: It called for appointment of three assistant inspectors general for the foreign aid department —one of whom was to be responsible for inspection of "engineering, construction and operations" and was to be a qualified professional engineer. But a conference committee adopted broader Senate wording, and Congress accepted this wording in the law. Specifically, it provides that (instead of inspectors general), there are to be nine **Assistant Administrators.** One of these will head the **Development Loan Fund,** and "in his selection, due consideration should be given to persons qualified as professional engineers." That leaves a President all sorts of leeway to "duly consider" professional engineers (not otherwise identified in the law), and then proceed to appoint almost anyone he wishes regardless of engineering qualifications.

* * *

It is obvious that the cuts in foreign aid money and the huge proposed school construction program will mean **changes in outlook for the construction industry.** There will be some reduction, obviously, in U.S.-sponsored construction abroad. But in the area of school work, there's no indication that there will be anything like a slacking off. Actually, within the first six months of 1961, school district voters had approved bonds totalling more than $443 million, to pay for school construction projects.

* * *

There were ample funds, also, from other government sources. One of these is the **Community Facilities Administration** of the Housing and Home Finance Agency, which has loaned a total of more than $292 million to institutions of higher education in the first seven months of this year, for construction of housing, dining halls, service buildings and the like.

By the way, the CFA has sparked a resurgence in **public works construction** by planning advances to communities that topped $9.8 million within the first seven months of the year. This will result in construction with a total value of more than $555 million. Much of that total will be work in sewerage, water works, schools, but a smaller amount will be spent for hospitals, community buildings, even roads and bridges. As you may know, the CFA not only can advance money for planning (out of a $58 million revolving fund), but can loan money to smaller cities (50,000 or less) out of a newly provided $650 million authorization, if the communities can't get money in private markets at reasonable rates.

* * *

Congress started to clear up an anomaly in the **Bureau of Public Roads**—by finally eliminating the title of Commissioner, in favor of "Deputy Federal Highway Administrator." The fact is, the Commissioner's office had been vacant since early January, and the Commissioner has been actually serving as deputy ever since the 1956 Highway Act was put on the books.

* * *

The **New Mexico** and other **highway scandals** had an ominous effect: the Bureau of Public Roads announced appointment of five "program evaluation officers"—all with investigative, rather than engineering, backgrounds—to work in the ten BPR regions to investigate "any known or possible irregularities" that may appear. Four of the five new men have long FBI experience, one was an investigator for the General Accounting Office.

* * *

A number of relatively simple steps can greatly increase the capacity of **major city streets,** according to a five-man team (including three engineers, a psychologist and an attorney) who surveyed Washington's heavily travelled Wisconsin Avenue. Steps include: Repaving, removal of streetcar tracks and loading zones, construction of bus "bays" at principal corners, marking five lanes so that the middle lane can be reversed in the direction of heavy traffic flow, progressive timing of traffic lights, pedestrian control, prohibiting parking in narrower sections, converting some intersecting streets to one-way, prohibiting left turns. Capacity could be jumped as much as 25 percent by such measures, said the researchers.

* * *

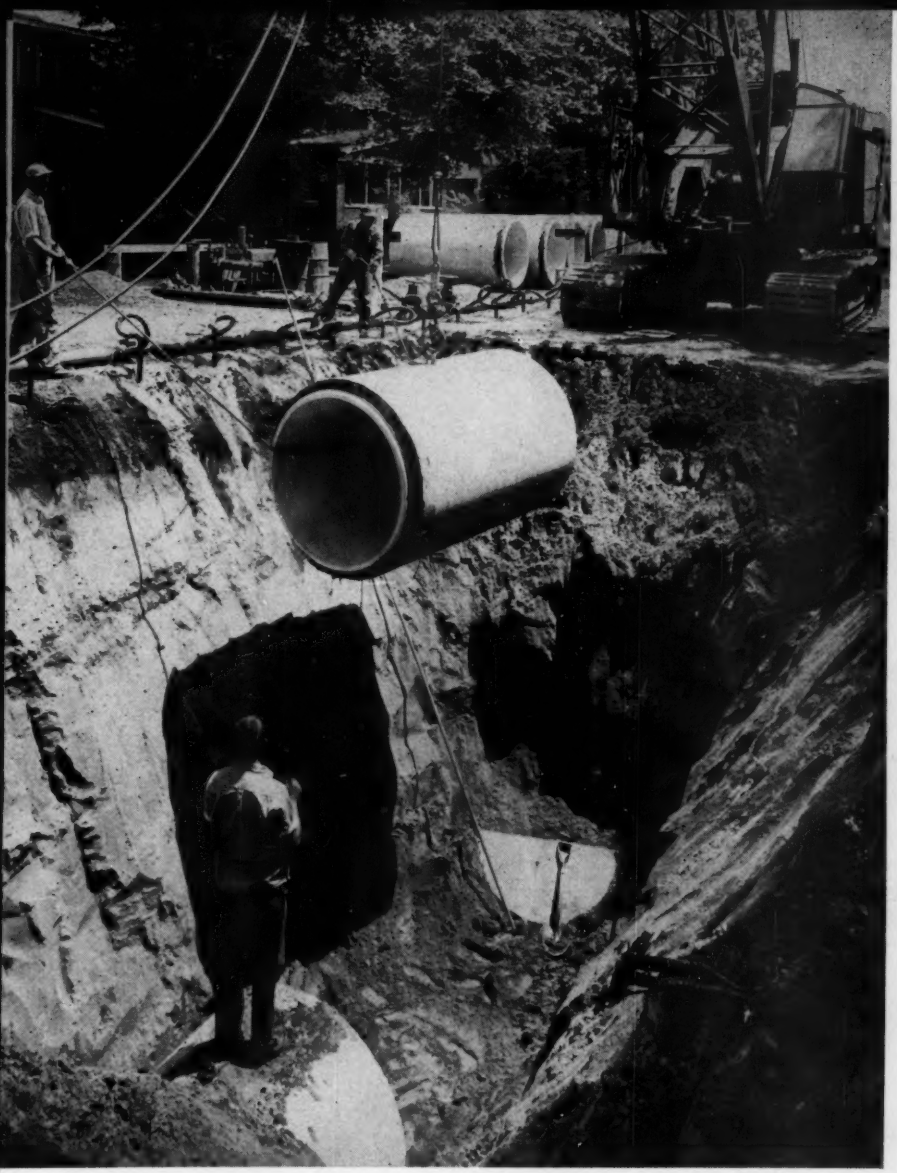
Washington's civil engineers are unhappy about being classed with plumbers, barbers, palmists and others by the city's **Department of Occupations and Professions.** And they're unhappier about being required to submit to a police-record check before licenses are issued to applicants, even though there are specific provisions that such checks need not affect decisions of the Professional Board of Engineering Registration. (Lawyers and doctors are not included in the Department's operations, though architects are). The reason for the tightening of police checks is the case of a local "lawyer" who turned out to be no lawyer at all, but who had prosecuted numerous criminal cases in city courts.

* * *

The **Army's Board for Rivers and Harbors** has approved 18 new civil works projects, involving federal funds that will eventually total more than $259 million. Biggest project approved is the comprehensive plan for the Delaware River basin—Army engineers said that an eight-project start would cost the government $130 million, and if the project were built to the full 58 reservoirs planned, would cost a total of more than $591 million.

* * *

Waterways interests are taking no chances that new studies of transportation policies—due late this year from the Department of Commerce—will result in toll charges on boat operators. Their newly organized National Waterways Conference has cranked up its mimeograph machines to keep pressure against tolls on Congress. The Conference argues that tolls would increase costs of foodstuffs and other vital products shipped on the waterways, weaken the waterways industry to a point where it might damage defense needs.



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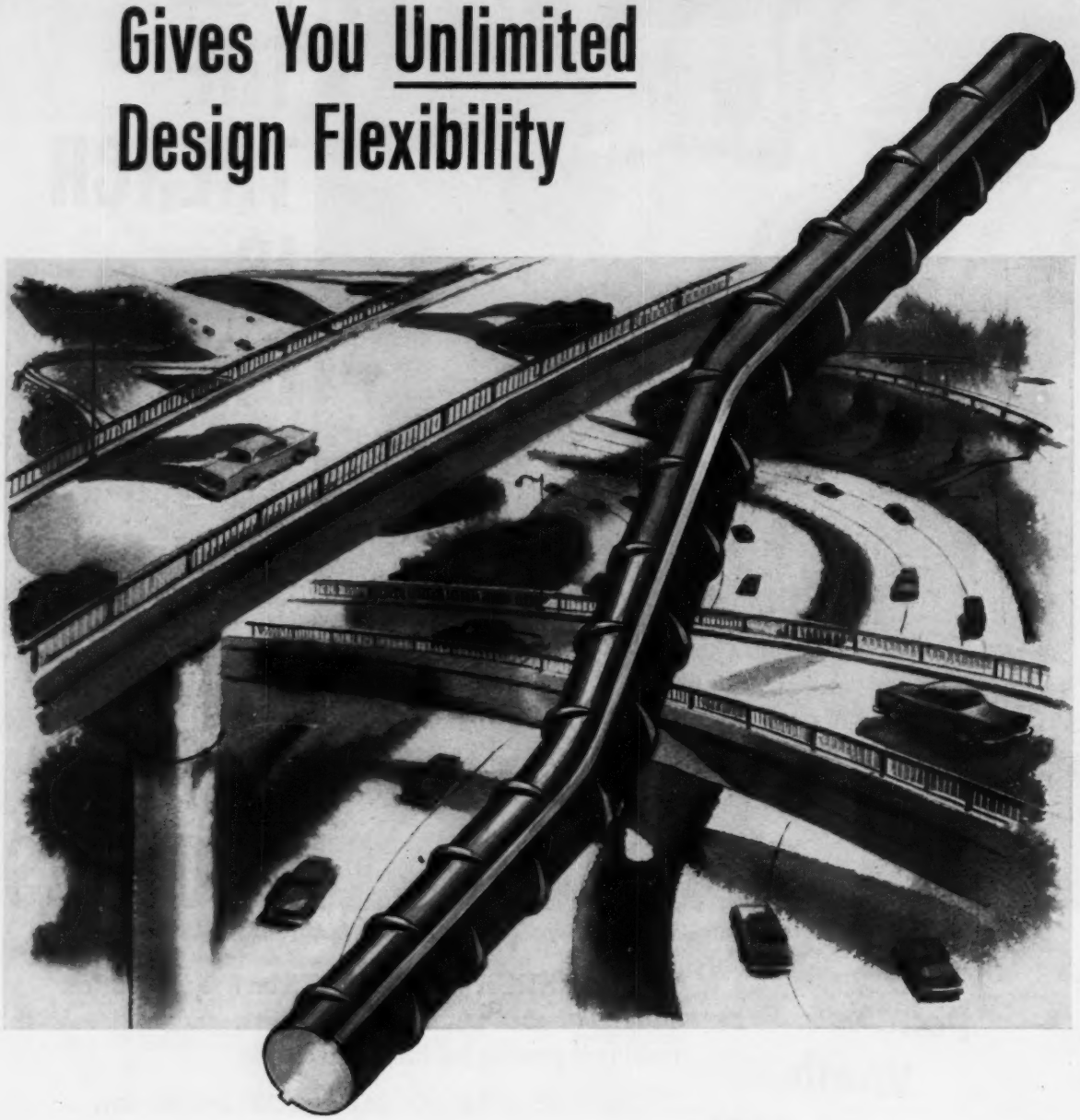
Monolithic REINFORCED Concrete Gives You Unlimited Design Flexibility



Monolithic reinforced concrete provides complete freedom to meet the requirements of terrain and traffic load—greater opportunity for unlimited creative design. Because of its lower cost—proved by government cost comparisons over a three-year period—it further provides greater construction economies than other structural materials.

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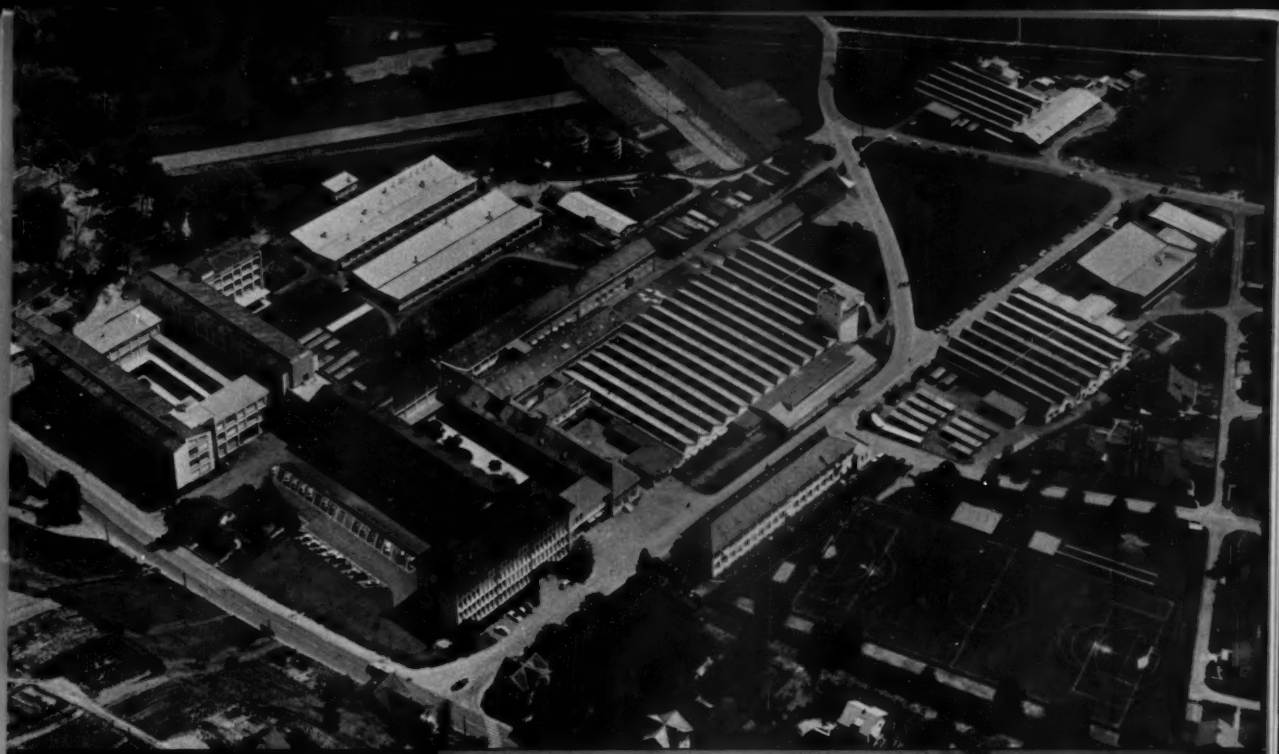

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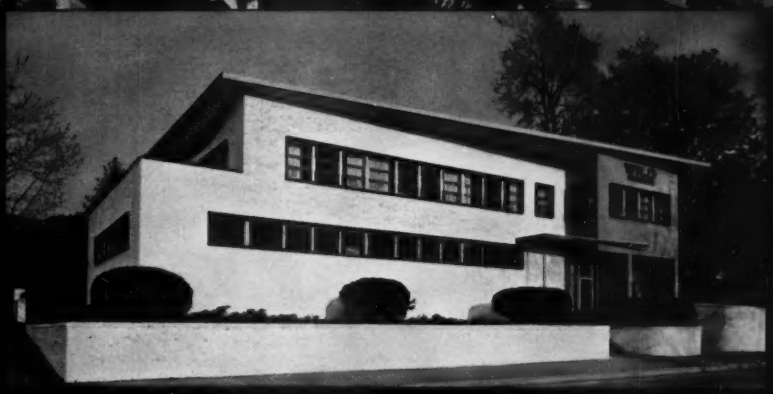

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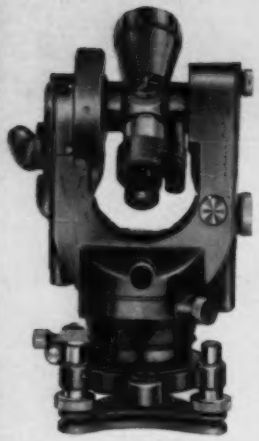
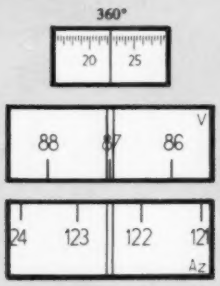
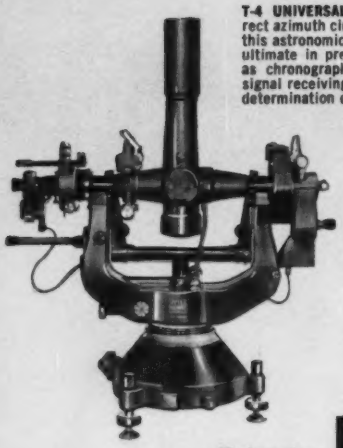


T-1A OPTICAL REPEATING TRANSIT— Embodies the latest developments for fast, accurate work. Micrometer reading to 20 seconds direct, self-indexing vertical circle, upper and lower azimuth motions for setting on zero and repeating. The ideal instrument for land surveying, layout and topography.

Also furnished with erecting telescope, Model T-1AE.



Vertical circle reading
87° 22' 20"

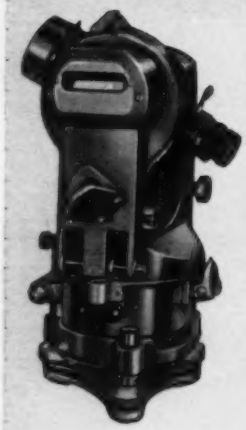


T-4 UNIVERSAL INSTRUMENT—W
rect azimuth circle readings to .1
this astronomical theodolite prese
ultimate in precision. Attachment
as chronograph, chronometer an
signal receiving set are available
determination of geographic posit

Horizontal or azimuth circle

Reading:
146° 27' 19.2"

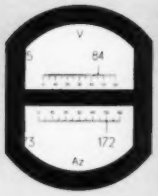
WILD INSTRUMENTS ENCOMPASS A BROAD RANGE OF REQUIREMENTS FOR ENGINEERING, SURVEYING, PHOTOGRAMMETRY, ASTRONOMY AND MICROSCOPY.



T-16 OPTICAL TRANSIT— Features quick circle readings by direct reading scale to 1-minute and 20 seconds by estimation (no need to set micrometer). Repetitions and zero setting are made with a circle clamp which eliminates conventional upper and lower motions. Alternatively available with horizontal circle graduated and numbered in both directions. Main uses are for mining, construction and building surveys, layout and general engineering.

Also furnished with erecting telescope, Model T-16E.

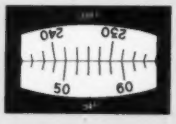
360°



Vertical circle 84° 45.6'
Horizontal circle 172° 50.5'

T-0 COMPASS THEODOLITE— A small lightweight instrument for reconnaissance and forestry surveys. Horizontal circle reads to 1 minute direct and can alternatively be used in fixed position or as a compass, making the T-0 ideal for compass traverse.

Compass circle



M-20 RESEARCH MICROSC

RUMENT—With di-
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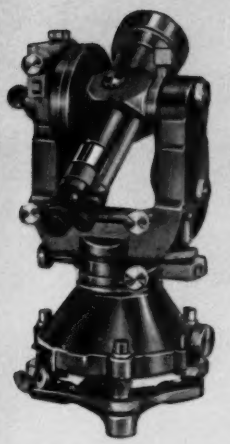
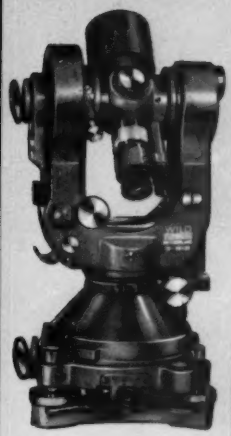


T-3 PRECISION THEODOLITE—Recognized the world over as the most versatile and precise theodolite for 1st and 2nd order triangulation. Minimum graduation of micrometer .2 second of arc. Available with a complete range of accessories for astronomical use, measurement of deformation and autocollimation. Model T-3A features built-in autocollimation eyepiece for industrial and laboratory applications requiring extremely accurate angular measurements.

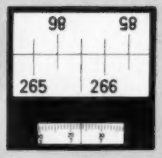
Horizontal circle (360°)

Circle reading	166° 40′
1st drum reading	39.3″
2nd drum reading	39.4″
	166° 41′ 18.7″



T-2 UNIVERSAL THEODOLITE—First produced in 1922 and now incorporating the latest design features, this 1-second theodolite is world renowned for its accuracy, ruggedness under adverse field conditions, and speed of operation. Main uses are for triangulation and precise angular measurements in industry and laboratories. Accessories, such as invar subtense bar, diagonal eyepiece set, Roelof's solar prism and autocollimation eyepiece, are available for specific applications.

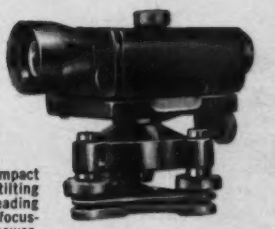
Also furnished with erecting telescope, Model T-2E.



Horizontal circle (360°)

Circle reading	265° 40′
Drum reading	7′ 23.5″
	265° 47′ 23.5″

Each is backed by unsurpassed service facilities in equipment, parts, and skilled factory graduate technicians.



N-10 LEVEL—A very compact surveyor's level with tilting screw and coincidence reading tubular level. Internal focusing telescope has 20 power, coated lenses.

Model N-10E with erecting telescope will be available later.

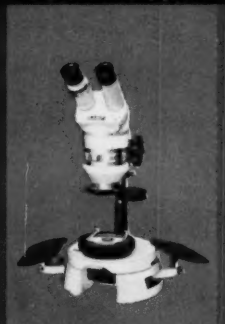
NK-10 Precision Level is fitted with horizontal circles for angle readings to 1-minute by estimation.

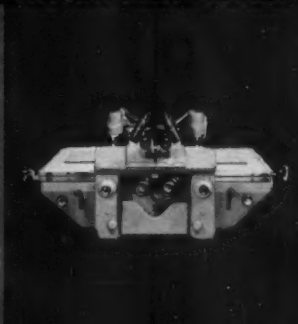
N-2 ENGINEER'S LEVEL—An efficient, accurate level for general engineering work, roads, bridges, construction, tunnels, etc.—24 or 28-power telescope with coated lenses—internal focusing—clamp and tangent screw—tilting screw with leverage—coincidence-reading tubular level—completely covered—telescope rotatable around its longitudinal axis for checking level adjustments quickly—lightweight—accurate—durable. NK-2 Precision Level is fitted with horizontal circles for angle readings to 1-minute by estimation.

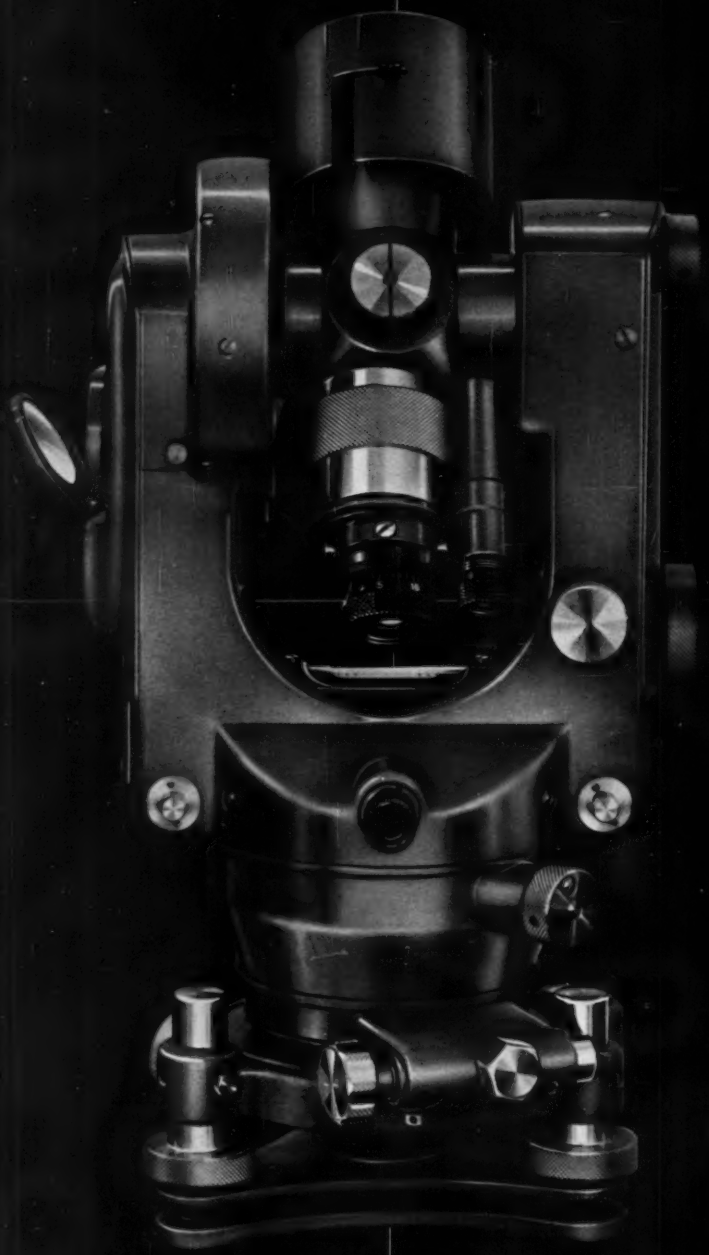
N-3 PRECISION LEVEL—The ultimate in precise levels—accuracy in 1 mile of single leveling ±0.0008′ using Wild invar Rods—used extensively for first-order leveling in industry, aircraft tooling, etc., where extreme accuracy is demanded. Available in three different micrometer readings: Metric—with micrometer reading to 0.1 mm; by estimation to .01 mm. Industrial Model—with micrometer reading directly to .001″ with ½″ travel. Civil Engineer's Model—with micrometer reading to .0005 ft. with 2/100 ft. travel.

N-0 LEVEL—A small, easy to use builder's level, particularly suited for construction work. Fully enclosed telescope with internal focusing. Instrument moves in azimuth by friction axis. Tubular level is viewed in adjustable mirror from behind the instrument.

H MICROSCOPE | M-4 MICROSCOPE | M-11 MICROSCOPE | M-5 STEREOMICROSCOPE | RC-9 120° AERIAL CAMERA | PUG-2 POINT TRANSFER INSTRUMENT







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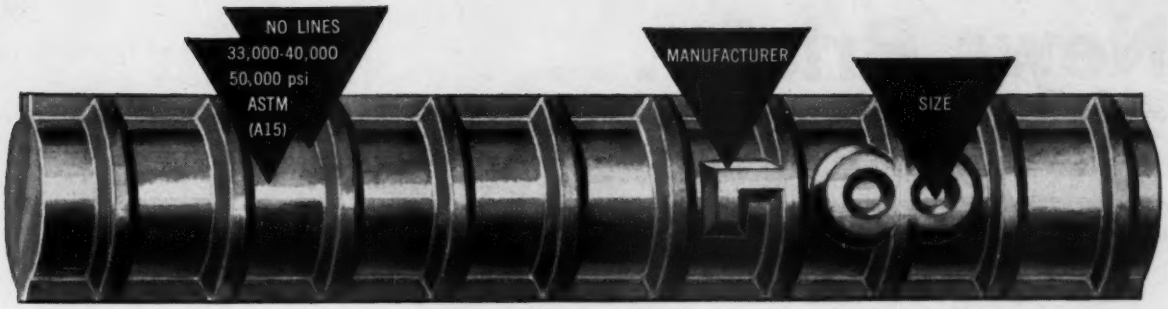
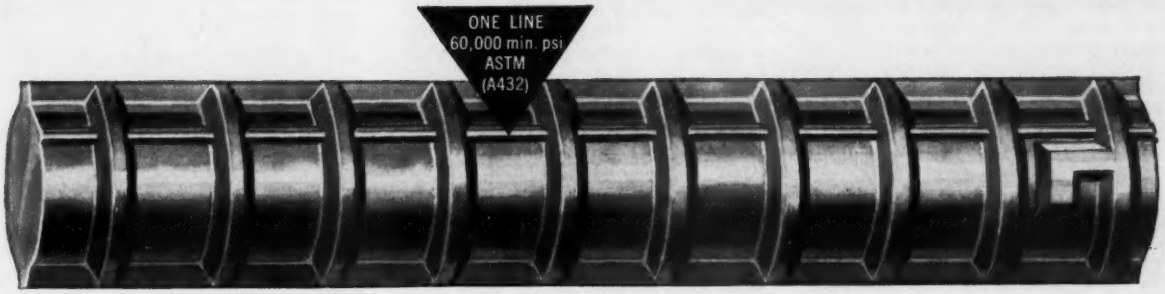
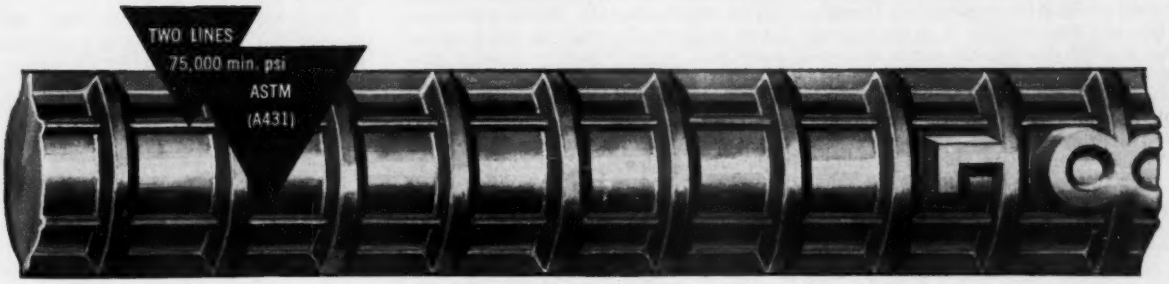


ROLLED-IN MARKINGS



SHOW SIZE AND STRENGTH



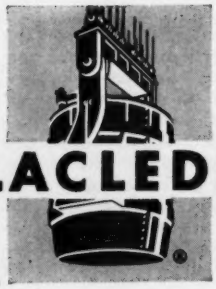
OF EVERY LACLEDE STEEL REINFORCING BAR

fast, easy identification saves construction time and cost

Metallurgical research has developed high-strength steels that substantially improve the efficiency and economy of reinforced concrete design — saving as much as 15% of the total construction cost of the structure.

Laclede now brings you this steel reinforcement in new, easy-to-identify bars that can be used with assurance under the Ultimate Strength design methods of the A.C.I. building code. With this positive identification, the worker can quickly find the right bar specified for the job. The clear marking of the grade of steel minimizes the need for inspection and testing.

Specify these time-saving, money-saving Laclede bars for your next construction job.



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News Briefs . . .

California Water Plan Outlined at Drought Conference

The timetable on the California Water Project was outlined by Governor Edmund Brown at twin dry-year water conferences held in Sacramento and Los Angeles this summer. The project (December 1960 issue, page 52) for which California voters approved a $1¾ billion bond issue last November, is now under construction. The state's present schedule, he said, calls for delivering water to the southern terminus of the project (the Perris Reservoir in Riverside County) by 1972—"the year Southern California will have to have the water to sustain life and growth."

On the more immediate agenda, Frenchman Dam in Plumas County will be completed in a few months. Construction of Antelope Valley Dam will begin next May. The Governor said that this dam, planned entirely for recreational purposes, "is typical of the new developments so vital to the north [of California] and to the economy of the entire state.

"All major relocation work at Oroville Dam and Reservoir site is to be finished late in 1962. Two bridges are to be completed there, and all five railroad tunnels are holed through. Two of these are completed, and three are under construction. The remaining bridge, the spectacular West Branch, will be finished in 1962.

"The first embankment work on Oroville Dam begins next year, and work on the spillway will start in 1964. The dam will be finished four years later."

In regard to the California Aqueduct, he said that the state is now acquiring the rights-of-way, and that major construction is scheduled to start in 1963. That same year work will begin on the San Luis Dam and Reservoir, in western Merced County. On this project—a key facility in further expansion of the Central Valley Project and in successful operation of the state's Feather River Delta Project—the state will work with the U.S. Bureau of Reclamation.

"With the completion of the first reach of the South Bay Aqueduct," Governor Brown said, "we expect to deliver water to the Livermore Valley next year. When the aqueduct is finished, surplus water from the Delta will serve Alameda, Contra Costa, and northern Santa Clara counties.

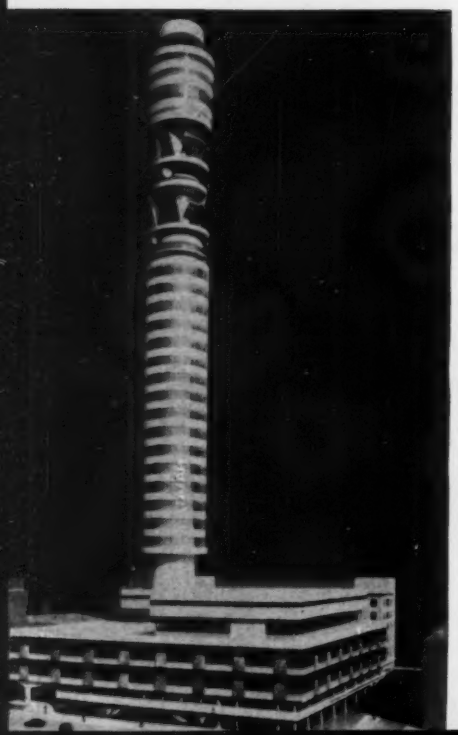
"Moving on down our wealth-producing river [the Feather], we will get water to Kern County in 1968. Before this, however, sometime in 1964, we will have begun work on the Tehachapi tunnels, aiming for a completion date of 1969. The Antelope-Mojave Valley canals will be dug between 1965 and 1970.

"Cedar Springs Reservoir in the San Bernardino Mountains will be started in 1967 and should be completed three years later. The same schedule is planned for the Castaic Reservoir. Also in 1970, we will begin work on the Perris Reservoir and we will fill it up in 1972."

Addressing the evening banquet at the Los Angeles Conference, Secretary of the Interior Stewart L. Udall emphasized the role of research in solving California's future water supply problems, particularly in the metropolitan area of Southern California. As two cases in point, he referred to progress that is being made in research in desalizination of water and reservoir evaporation control.

An intensified program of ground-water replenishment, while surplus Colorado River water is available in Southern California, was urged by Robert B. Diemer, manager and chief engineer of the Metropolitan Water District of Southern California. He urged that cities and water companies in the area reduce pumping from underground stores and take delivery from Metropolitan Water District pipelines whenever possible.

The two drought conferences were called by Governor Brown in an effort to alleviate conditions arising from the drought that has prevailed in California for two successive years. Over 800 attended the two conferences.



Britain's Tallest Building

New London landmark will be a 500-ft television and radio tower, shown in scale model. To be built in central London by Britain's Ministry of Works, the building will be the tallest in Great Britain. The glass and concrete tower, which is only 54 ft in diameter, will be connected to the main structure by a bridge (not visible here) 80 ft above ground level. Designed for the Post Office (which administers the British telephone system), the structure will feature a restaurant with revolving floor. The foundation, now under construction, will be a 90-ft-square slab of prestressed reinforced concrete. Completion is scheduled for 1963.

Steel Contract for Ohio River Bridge

Award of a contract for construction of the steel superstructure for a new Ohio River bridge between Cincinnati, Ohio, and Covington, Ky., has been announced by the Kentucky Commissioner of Highways. It will be the first highway bridge connection between Cincinnati and Kentucky built in half a century. The new bridge, a through-cantilever structure, 1,736 ft in length, is scheduled for completion in June 1963. Each deck of the double-decked structure will have two 42-ft roadways, and each deck will carry traffic in one direction.

First shipments of steel will be made in the spring of 1962, with completion of steel erection scheduled for fall of the same year. Pier foundations on both sides of the river, as well as two river piers, are under construction. The multi-million-dollar project will ultimately link the new Interstate Highway System in Kentucky with the Mill Creek Expressway in Cincinnati and the Ohio Interstate System.

Modjeski and Masters, of Harrisburg, Pa., are the designers. The substructure work is being performed under a contract previously awarded to the joint venture of Ruckman & Hansen, Inc., Fort Wayne, Ind., and Roy Ryan Sons Co., Inc., of Evansville, Ind.

U. S. Group to Build Afghanistan Road

The Corps of Engineers has awarded a contract for the construction of a 300-mile modern paved highway in Afghanistan. The project will be part of the International Cooperation Administration's economic-aid program to the Government of Afghanistan. The low-bid contract goes to a joint venture made up of the following firms: Oman-Farnsworth-Wright, New York, N. Y.; the Morrison-Knudsen Company, Inc., Boise, Idaho; the J. A. Jones Construction Company, Inc., Charlotte, N. C.; and Peter Kiewit Sons Company, Omaha, Nebr.

The $40 million contract calls for the construction of a two-lane asphalt-surfaced highway from the Afghanistan capital of Kabul, located in the east central portion of the country, to Kandahar, a commercial center to the southwest.

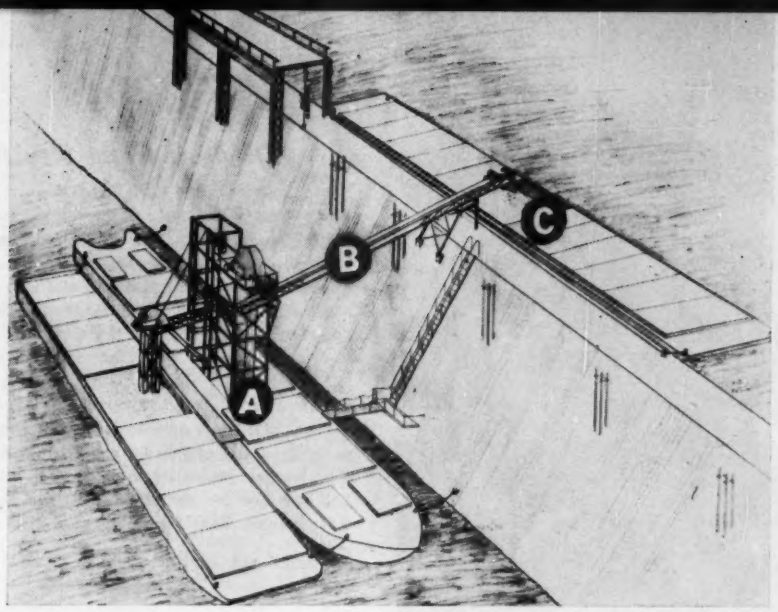
The cost of the highway will be paid for with ICA foreign aid funds, supplemented by local currencies. The Corps of Engineers will supervise all construction, at the request of ICA.

Science Center Proposed for San Francisco Waterfront

The Board of Governors of the International Science Foundation has requested approval of the San Francisco Port Authority for development of a $65,000,000 International Science Center on the San Francisco Embarcadero. The project will involve redevelopment of an area now occupied by four piers if the proposal is accepted by the Port Authority. The Science Center would be the first project in an "Embarcadero City" plan for redevelopment of the waterfront.

The proposed Science Center would be the second in a series of pilot centers, which are being sponsored by the International Science Foundation as an outcome of the Brainpower Forum Conferences conducted at the U.S. Naval Postgraduate School. The Brainpower Forum was established several years ago as an industry-education-government group, with the objective of developing policy on common problems in the area of scientific manpower. At the close of the 1956 conference, Forum participants recommended that the Foundation initiate a program of developing experimental science centers that would give scientists the physical facilities needed for them to render maximum service.

In "International Cooperation in Science," quarterly newsletter of the International Science Foundation, the proposed center is compared to the new United Engineering Center. In addition to providing facilities for San Francisco sections of engineering and scientific societies, it would offer service facilities to international scientific organizations, international engineering firms, and many other allied groups and interests.



Barge Elevator to Lift Grain Over Wheeler Dam

A floating grain elevator will start grain moving again past Wheeler Dam, where a collapsed lock has tied up shipping on the Tennessee River above Florence-Sheffield Ala. (July issue, page 85.) The special barge—developed by engineers of Cargill, Incorporated, Minneapolis grain-handling firm, as a solution to the problem—is shown here in engineer's drawing. The 243-ft barge, equipped with special elevating and conveying machinery, will be sunk in 8 ft of water on the downstream side of the dam. Elevating machinery will lift grain from barge at left, transferring it to the self-loading craft adapted by Cargill. Equipment on craft (A) further elevates the grain to a conveyor (B), which lifts it the remaining 60 ft over the dam into the barge (C) for delivery up-river from the lock and dam. The Tennessee Valley Authority will rent the equipment from Cargill, and operating costs will be shared by eleven grain companies. Grain comprises about 65 percent of the tonnage moved past the dam.

Ethiopia Starts Airport Improvement Program

The ancient Empire of Ethiopia moved closer to the jet age with the recent signing of a contract by the Ethiopian Government for the start of construction on a major civil airport improvement program. The contract, signed with the international engineering firm of Grove, Shepherd, Wilson and Kruge, Inc., of New York, calls for completion of the work in 1962.

The contract includes construction of a new jet airport at Bole on the east side of Addis Ababa. A jet runway will also be added to the present Asmara international airport. In addition, many improvements are scheduled at Jimma, Dire Dawa, and 22 other Ethiopian cities and towns, with the work to include new terminal buildings, night-lighting facilities, crash tenders and fire-fighting equipment, new navigational aids and communications installations. The new Addis Ababa airport will have a completely modern landing field, with a terminal building, freight warehouse, and fire and meteorological stations.

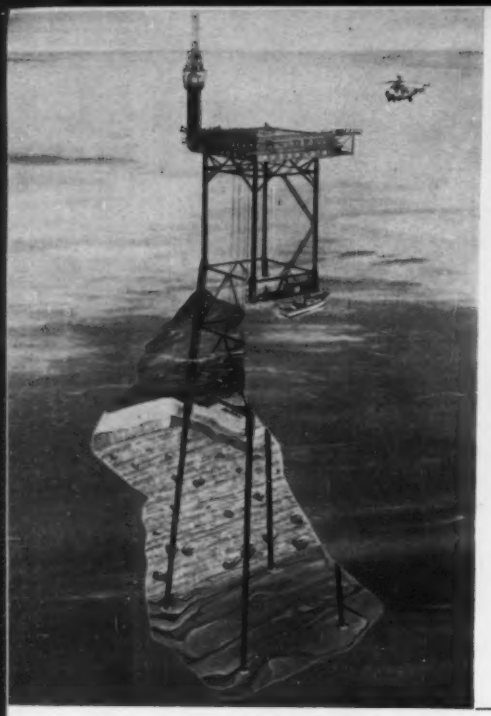
Financing of the airport construction work will come mainly from a loan of $20,250,000 recently made by the Development Loan Fund in Washington, D.C., which has also made a second loan of $3,100,000 for the purchase of overhaul equipment and spare parts for the two new Boeing 720B jets ordered by Ethiopian Airlines.

Plans for the airport improvement program were drawn up by the architect-engineering firm of Ammann & Whitney-Husted.

New Water Filtration Plant for Pittsburgh

On September 20, the South Pittsburgh (Pa.) Water Company dedicated a new 25-mgd treatment plant called the E. H. Aldrich Filtration Plant. The new installation, said to be one of the most fully automatic in the country, will treat Monongahela River water polluted by acid mine wastes. All remote controls required to operate the plant are housed in a central control room, with an area of less than 1,400 sq ft.

The six-acre plant site includes provision for additions to 100-mgd capacity.



Offshore Light Structure for U.S. Coast Guard

Photo, released by U.S. Coast Guard headquarters in Washington, shows artist's conception of Buzzards offshore light station, which will be put into service later this year. The structure will replace Buzzards Lightship at the southern approach to Cape Cod Canal off the Massachusetts coast. Upper deck of structure will have living quarters for five, and the roof will serve as a helicopter landing deck. A second offshore structure, to be completed later this year off Newport, R.I., will not be manned. For reasons of economy, the Coast Guard will replace 22 lightships with structures of this type in the next decade. The four-legged template-type design was chosen for the Atlantic Coast installations because of its adaptability to various water depths and its ease of fabrication, transportation, and erection. The trussed template design also prevents serious bending moments in the legs, regardless of depth, permitting use of slender members with resultant decrease in wave forces. The design was prepared by the Civil Engineering Division at Coast Guard headquarters. The low bid for construction of the first two stations was submitted by the Perini Corporation, East Boston, Mass.

Institute of Traffic Engineers Meets in Washington

More than 1,000 delegates from 31 countries attended the World Traffic Engineering Conference, held in Washington, August 21-26. The first three days of the conference, the first in history, were devoted to the 31st annual meeting of the Institute of Traffic Engineers, and the last three to International Sessions in Traffic Engineering.

At the conclusion of the conference many of the delegates boarded buses for a one-week study tour of highway facilities and transportation planning in Washington, Baltimore, Philadelphia, New York, and New Haven and Norwalk, Conn.

Inability, in the past, to control the forces of change and growth which are operating in our cities has been the key factor in the creation of our present urban problem, Howard Wharton, deputy commissioner of the Urban Renewal Administration, told the conference. He emphasized that transportation planning must be correlated with overall regional planning to bring about proper urban development.

Principles that can be stated with assurance he said, are:

"1. We won't solve the urban transportation problem merely by building wider streets and more highways.

"2. Transportation planning must be closely coordinated with general land-use planning.

"3. The location of homes and jobs is an important part of transportation planning."

New street patterns, designed to keep through traffic on major arterials and away from local residential streets, were described to the delegates by Harold Marks, administrative civil engineer of the Los Angeles County Road Department.

He pointed out that, traditionally, streets have been laid out in gridiron fashion, but said: "The inadequacy of the grid pattern became obvious as traffic continued to grow." Traffic engineers resorted to a number of expedients to discourage through traffic but they have not proved effective.

The trend to the suburbs throughout the United States will continue in the years to come, Philip Hammer, of Hammer and Company Associates, predicted. However, he conceded that some "significant counter trends" have been evident—central business district revitalization and close-in housing developments.

"At the most, however," he said, "rebuilding the central core will account for only a fraction of the total new investments that will be made in new metropolitan facilities in the next decades. An even smaller proportion is likely to trickle into declining intermediate areas between downtown and the suburbs where the prospects for capital returns are dubious —even on many arteries of commercial strip development."

Inter-connection of traffic signals in the central business district of smaller cities was recommended. Robert A. Mitchell, chief engineer of the Wilmington (Del.) Street & Sewer Department, told the group: "In my opinion, multi-dial controllers, interconnected and supervised by a master controller, should adequately handle the flow of traffic.

"The great technological advancement in traffic signal controllers, electronic devices, detectors, etc., has placed better tools in the hands of traffic engineers for controlling street traffic." One-way streets were recommended by Mr. Mitchell as an alternative to a modern master-controlling system.

A special committee of the Institute of Traffic Engineers reported that the relatively new policy of painting white lines on the edges of highways as a traffic safety aid is now by all odds the most popular traffic safety policy introduced in recent years.

The edge lines should be white, reflectorized, solid lines ranging in width from 2 to 4 in., with the 4-in. width strongly urged.

Edgelining was virtually non-existent as recently as eight years ago, and it has only been in the past two and one-half years that it has gained real momentum. Illinois recently became the nation's first state to enact legislation that makes edgelining mandatory on all highways with an average daily traffic of more than 1,000 vehicles.

Gordon K. Gravelle, F. ASCE, deputy commissioner and chief engineer of New York City's Department of Traffic, was elected president of the Institute of Traffic Engineers. He succeeds Alger F. Malo, director of streets and traffic for Detroit, Mich. New vice presidents are Robert A. Burch, state traffic engineer, State Highway Commission, Raleigh, N.C., and J. Al Head, F. ASCE, assistant traffic engineer, State Highway Department, Salem, Ore. Fred W. Hurd, director of the Yale Bureau of Highway Traffic, New Haven, Conn., is secretary-treasurer.

Construction Spending Rises in August

Spending for new construction in August came to $5.4 billion, according to preliminary estimates of the Bureau of the Census of the U. S. Department of Commerce. This represents an increase of 1 percent over July expenditures—considered normal for the period—and of 4 percent over the August 1960 level of spending.

Expenditures for private construction this August came to $3.7 billion, matching the July level, but 5 percent above August 1960 outlays. Public construction spending this August, estimated at $1.7 billion, was 4 percent higher than in July and 3 percent above last year's level for the month.

Cumulative spending in the first eight months of 1961 totaled $37 billion, compared to $36.1 billion in the same period of 1960.

Radioactive Power for Automatic Weather Station

The world's first radioisotope-powered automatic weather station, to be used for beaming data from the remote Canadian Arctic, will be powered by a strontium-90 source prepared at Oak Ridge National Laboratory. The 17,500-curie source will provide heat to operate a small electrical generator for powering radio-telemetering equipment for the joint U.S.-Canadian weather station.

The new international weather station will be located on uninhabited Graham Island, about 400 miles north of Resolute. The installation had to be completed by late summer, as the area is completely inaccessible in winter. The station is designed for radio transmission of wind direction and speed, temperature, and barometric pressure every three hours to receiving stations at Resolute and Alert, Canada.

Oak Ridge Laboratory, one of the nation's largest nuclear energy research and development laboratories, is operated by the Union Carbide Corporation for the Atomic Energy Commission.

Mississippi River Parkway Takes Shape

Plans to border the Mississippi River, on both sides, with scenic highways extending from Canada to the Gulf of Mexico have been under way for some years. The projected route, authorized by Congress in 1954, is known as the Great River Road Project. Originally planned to extend from the headwaters of the Mississippi to the Gulf, the project now extends northward to encircle the Lake of the Woods in Manitoba and to connect with the Trans-Canada Highway. With a length of 4,000 miles, it will be the longest freeway in the world.

Through use of existing highways, the project is about 60 percent complete, and bills to speed planning and construction of the remaining mileage are now before Congress. These bills would provide appropriations of around $2,000,000 to buy property needed to preserve the scenery along the route. Plans for speeding the project were also made at a four-day Parkway Convention, held at St. Francis, Ontario, early in September.

An interesting feature of the proposed route through Louisiana is a plan to use the Old River closure structure (April 1960 issue, page 60) for the road bed. Here the road will cross both the overbank structure and the low-sill structure, and continue on the earthen dam now under construction and along the Morganza Spillway. In other areas, the Great River Road will be built atop levees.

To preserve the traditions of the river, the green and white markers used to indicate finished portions of the route are replicas of the old pilot wheels used on river steamers. River lore is also preserved in the designation of "pilot" for the head of the Mississippi River Parkway Planning Commission. J. Lester White, F. ASCE, Baton Rouge, La., has been pilot for the past several years.

Generators Ordered for Round Butte Development

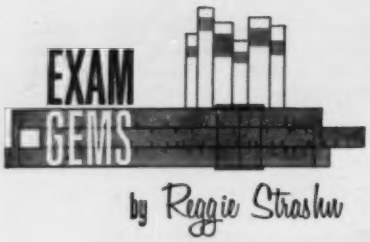
Allis-Chalmers will build three Francis-type hydraulic turbines for the Round Butte Hydroelectric Development of the Portland (Ore.) General Electric Company. The turbines will develop 115,000 hp each, and the generators will have a capacity of 82,350 kw.

The site of the Round Butte Development is along the Deschutes River, a tributary of the Columbia in Jefferson County, Oregon. The plant will be upstream of the Portland General Electric's Pelton Project. The scheduled completion date is October 1964.

Engineers for the project are the Bechtel Corporation, of San Francisco.

Girder Launcher Speeds Work on Seattle Freeway

Unique new device, known as a "girder launcher," is being used for positioning massive, prestressed concrete girders in the construction of a section of the Seattle Freeway. In this view telescoping extension beams reach out 70 ft for an exposed pier cap from a cantilevered 50-ton, 110-ft-long box-girder unit that can span an opening up to 100 ft across. As each girder is set in place, the launcher is moved laterally to the next girder location within the same span. The launcher was developed by the Seattle Structural Steel Division of Renton's Pacific Car and Foundry Company after conventional girder-setting methods were found impractical for the job. The joint-venture contractor on the job is the Morrison-Knudsen Co., Inc., and Rumsey & Company. The Seattle Freeway is a link in Primary State Highway No. 1, a current major building project of the Washington State Department of Highways.



R. ROBINSON ROWE, F. ASCE

Registration examinations often include a brief problem calling for a few definitions of engineering terms. Generally the set-up appears to be an unstudied last-minute fill-in. With "open-book," most answers are verbatim copies from permissible texts, proving only that candidates know how to use an index. With "closed-book," answers range from the pathetically naive to the ludicrously erroneous, proving only that many choose an engineering career because they flunked rhetoric.

Examgem 27 had a unique complication: the 16 words of 8 two-word terms were listed alphabetically. The pair had to be identified, then defined or described. Some words like *area, frame* and *ratio* would pair with more than one mate. With 240 possible permutations, an index was little help.

Candidates with broad knowledge of their field quickly noted the monogamous words that had only one possible mate. Using up 8 words in *pneumatic caisson sludge digestion, wide-flange girder* and *specific energy,* the left-overs (area, frame, jetty, moment, permeable, ratio, rigid, voids) reduced the possible permutations to 56.

The problem would still be a puzzle to the dullard, for 21 of these permutations are meaningful. Almost at random he might pair and define *frame area, rigid jetty, moment ratio,* and *permeable voids.* These 8 polygamous words made the problem a gem, because the lad who had been broadening his experience with outside technical reading saw more interesting combinations like *moment area, rigid frame, permeable jetty* and *voids ratio.*

There would be no point in defining here the 8 well-mated terms, since all can be found in standard references. However it is pertinent to condemn a common fault in extemporaneous definition of compounded terms—the fault of using the halves to define the whole. Suppose you were the examiner and read hundreds of answers like, "a wide-flange girder is a girder with a wide flange," "a rigid frame is a frame which is rigid," and "a permeable jetty is a jetty which is permeable." How would you grade them? All are correct statements, but none are definitions and none prove knowledge. How would you know the candidate knew what a jetty was, or whether its permeability was due to design or erosion?

However, the candidates had an option to define or describe. Lacking Websterian fluency, you can still paint a word picture of a familiar object and explain its function or process. Metric terms like *voids ratio* and *specific energy* can be defined by equations relating them to simpler terms, but don't forget to add a dimension or unit of measurement. Don't overdo it by writing a thesis, but just enuf to prove you know what the term means.

Gem quality of the problem was due primarily to its design to test knowledge of engineering terms, instead of casually listing some words that were readily found in an index. It was designed to perplex one-track minds and reward broader visions. One other will be cited for a similar reason but a different approach.

EXAMGEM 28

Part A. Define each of the following terms in its application to current engineering practice:

capital recovery	limited access
CBR strength	post-tensioning
constant radius	sand column
consumptive use	significant wave
desalinization	tellurometer
energy dissipator	Vierendeel

Part B. Describe this application in more detail (100 to 200 words) for any one of the above terms.

Schuylkill River Bridge Utilizes Long Plate Girder

Plate girders, 262 ft long, believed to be the longest ever erected in one piece, are being used by the Phoenix Bridge Company in a five-span plate-girder bridge being built over the Schuylkill River near Reading, Pa. Use of long girders was an economy measure, as conventional methods of lifting the steelwork into place in four sections would have entailed the expense of extra falsework. The 98-ton girder, ready to be lifted into place, is shown resting on a temporary steel bridge where it has been welded into a single unit. The 618-ft bridge, one of three being erected over the Schuylkill River for the Pennsylvania State Highway and Bridge Authority, is part of a new U.S. Route 422 bypass around Reading.

Army Authorizes Delaware Dredging

The U. S. Army Corps of Engineers has awarded a $5,821,200 contract to the American Dredging Company, of Philadelphia, for dredging the Delaware River channel in the vicinity of Bristol, Pa., according to an announcement from Col. T. H. Setliffe, district engineer. About 5,292,000 cu yd of material will be removed to deepen the channel to 40 ft and widen it to 400 ft. The downstream limit of the work is about 1,600 feet upstream from the Burlington-Bristol Bridge, while the upstream limit is the Pennsylvania Turnpike Bridge.

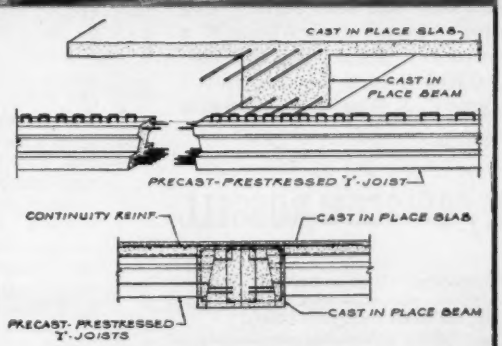
This work is part of the $80,000,000 project to deepen the Delaware River between Philadelphia and Trenton.

Bonds Sold for California Tramway

Work on a tramway that will carry passengers from Palm Springs, Calif., up Mt. San Jacinto is about to start, following sale of $7,550,000 worth of bonds to finance construction costs. The tramway will carry passengers to a point 8,515 ft up the 10,000-ft peak. Its capacity will be 80 passengers per trip.

The project is sponsored by the San Jacinto Winter Park Authority, which is headed by Earl Coffman.

Drawing shows how the prestressed concrete I-beam sections were integrated with the floor slabs to form tee-beam sections.
Architects: Lemmon, Freeth, Haines & Jones
Structural Engineers: (original steel frame) Austin, Smith & Assoc., Inc.
General Contractors: Hawaiian Dredging & Construction Co., Ltd.
Concrete Design: (for H&W Dredge) Alfred Yee



JOIST TO BEAM CONNECTION DETAILS

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PRESTRESSED CONCRETE

saves office building owner $70,000

This beautiful new office building in downtown Honolulu illustrates in an outstanding way the unique advantages and economies of prestressed concrete construction.

Originally designed for structural steel framing, it was redesigned and built with prestressed concrete at the suggestion of the contractor, the Hawaiian Dredging & Construction Co., Ltd. The result: the building was completed on schedule in 10 months at a cost $70,000 lower than the original bid!

The key to the efficiency of the design was the use of prestressed I-beam sections mass-produced at the precasting plant, transported to the construction site by truck trailer and set directly in place by crane.

To those familiar with prestressed concrete methods such economy is no news. To those planning to build and looking for ways to economize soundly, it should be welcome news indeed. If you have a structure in mind, now is the time to get the facts on prestressed concrete.

Roebling can give you the information you want. We pioneered the development of this construction method in this country... and produce the finest prestressing wire and strand available. A wealth of design data and practical experience is available to share with you. Write or call Roebling's Construction Materials Division, Trenton 2, N. J.

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DECEASED

Gosta Th. Alm (M. '61), aged 56, immediately after graduation from Sweden's Royal Institute of Technology in 1930 joined the staff at Vattenbyggnadsbyran in Stockholm, where he was consulting engineer for a great number of important water power projects. A partner in the firm since 1946, Mr. Alm specialized in foundation engineering and soil mechanics, and for part of the time was also employed by his alma mater as assistant professor of geodesy and of projective geometry.

John Ayer (M. '19; F. '59), age 78, in 1917 started his long association with the Boston, Mass., firm of Fay, Spofford & Thorndike, rising steadily from assistant engineer to executive engineer to division engineer, and in 1922 and 1956, respectively, to partner and vice president. For a time after his graduation from the Massachusetts Institute of Technology in 1905 he taught at his alma mater.

William Allmond Barr, Jr. (A.M. '52; M. '59), age 54, in his capacity of records engineer with E. I. du Pont de Nemours & Company, Inc., at Wilmington, Del., at the time of his death was engaged as historian for the Atomic Energy Section of the du Pont Company's engineering department. Mr. Barr had served with du Pont some 20 years, as engineer draftsman in the construction division, as material control engineer, assistant inspecting engineer, and appraisal and valuation engineer. On at least two separate occasions he was for extended periods on special assignment with full supervision and responsibility for the preparation of confidential engineering reports.

Lloyd E. Brace, Jr. (A.M. '57; M. '59), age 36, had been with the Corps of Engineers since 1944. In 1956 after a brief tenure in North Dakota, he was transferred to Omaha, where as part of his specialized knowledge of soil mechanics he engaged primarily in studies of and design of excavation side slopes, and dam and level embankments. Earlier, from 1943 to 1947 (except for a short period of military duty) he was employed as an engineering aide in the laboratory operated by the Missouri River Division.

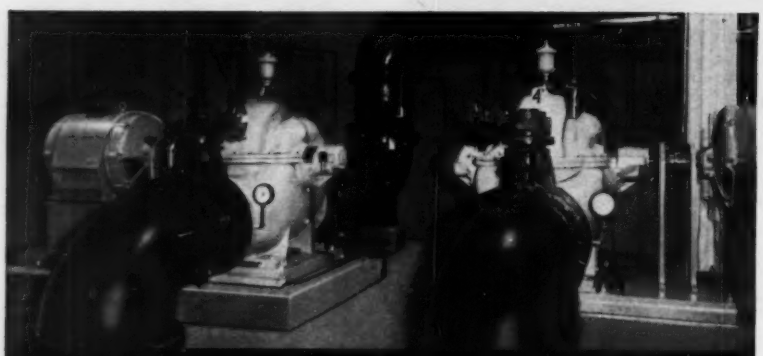
John P. Congdon (M. '11; F. '59), age 86, after several years as a private consultant in Boise, Idaho, joined the Boise Cold Storage Company in 1918 as secretary-treasurer. In past years until his recent death, Mr. Congdon was president of the firm.

William C. Gibson (M. '36; F. '59), age 46, in 1950 an associate professor of public health engineering at the University of Michigan School of Public Health, when he died recently was associate dean of the School. His appointment to the latter post was made in January 1961, after four years as secretary of the School of Public Health faculty and one year, 1959-1960, as acting dean. On the international scene, Dean Gibson conducted a public health evaluation of community development programs in India, Iran, Egypt and the Gold Coast in 1955, and in 1959 under sponsorship of the World Health Organization was similarly engaged in Turkey, Israel, Ethiopia and Liberia.

Miroslav V. Jiranek (M. '57; F. '59), age 53, for a short time before his death was with the Corps of Engineers in San Francisco, having previously been employed by Porter, Urquart, McCreary and O'Brien. Holder of a doctorate from the Czech Technical University in Prague, Dr. Jiranek was owner of a general contracting firm, consulting engineer, and professor in his native Czechoslavakia prior to coming to the United States in 1948. From that year until 1959 he was with the International Engineering Company, Inc., which he served as design engineer, job engineer, and finally senior civil engineer.

William F. Jordan (A.M. '91; M. '59), age 97, retired in 1932, after more

(*Continued on page 110*)



"Push-Button" WATER TREATMENT PLANT USES C.H. WHEELER PUMPS

● At the ultra-modern water treatment plant in the Torresdale section of Philadelphia, automatic and semi-automatic controls direct water flow, sedimentation, filtration, chemical treatment, feeding rates, and all other operations.

One operator by flipping a few switches automatically controls the cleaning of four filter beds simultaneously—*AND THE OPERATION TAKES ONLY HALF AN HOUR.*

Four C. H. Wheeler 24" x 20" Horizontally Split Case Double Suction Pumps (witness-tested at 91% efficiency at the C. H. Wheeler Test Laboratory, operating against a head of 72 feet at 880 RPM) can pump as much as 80,000,000 gallons of water a day. With automatic "Push-Button" regularity these four C. H. Wheeler Pumps replenish two steel tanks with the wash water required to clean the 94 rapid sand filter beds. Surface wash water for the filter beds is supplied by three additional C. H. Wheeler 6" x 5" Double Suction Pumps, each with a capacity of 1,500,000 gallons a day, operating against a head of 210 feet, 1760 RPM.

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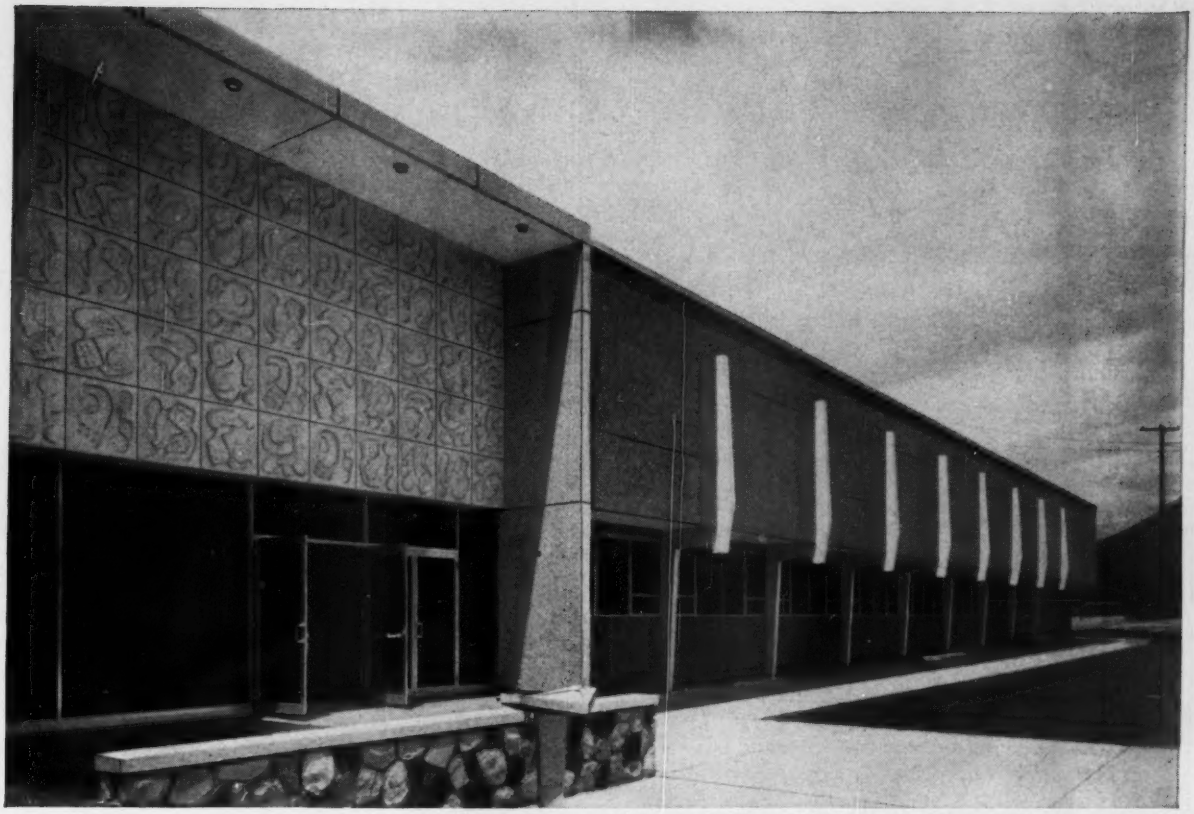

General Purpose Addition to the Central Utah Vocational School, Provo, Utah. Architects: Dixon, Knell & Long, Provo, Utah. Engineer: Hugh McKellar, Provo, Utah.

Fire safety came first—economy's a bonus in this low-cost, all-concrete school

Stepped columns support the prestressed concrete frame. Offset provides extra 4 feet of classroom space on second floor and built-in sunshade over first floor windows.

Fire protection is a vital consideration when building a school. This was one reason the architects chose all-concrete construction for the new General Purpose Addition to the Central Utah Vocational School at Provo.

And use of concrete in its newest forms gave opportunity for economy, too. The entire shell of the building, including prestressed concrete roof, frame and floor beams, precast columns and curtain wall panels, was completed for $3.21 per sq. ft.

All this and beauty, too. The warm texture of the exposed aggregate panels contrasts with the clean lines of the unusual stepped columns. Panels are "sandwich" type. No additional finishing is needed for interior surfaces. Over the entrance, small panels cast with plaster forms depict tools of industry.

More and more engineers are finding that concrete offers opportunity for money-saving construction.

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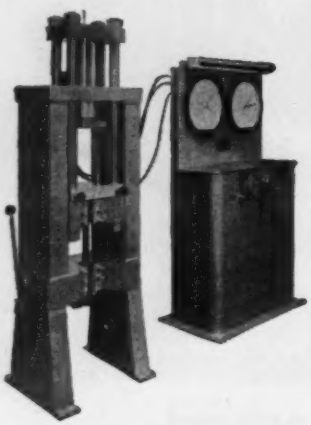

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than 30 years as principal assistant engineer of the New York Central Railroad. Among his major projects were the Grand Central Terminal, the Castleton Cutoff over the Hudson River below Albany, N.Y., and the Buffalo and Syracuse terminals.

H. R. Kallgren (A.M. '37; M. '59), age 63, for the last 15 years was a structural engineer for the Fifth Naval District at Norfolk, Va. Early in his career he was an engineer with Giffels & Vallet, a Detroit firm that had a Navy contract in Norfolk. At the close of the contract in 1946, Mr. Kallgren continued there as a public works engineer for the Navy.

Sidney C. Leverock (M. '59; F. '59), age 50, during his 20 years as a practicing engineer specialized in the structural design of large power plants and oil refineries, including an Atomic Energy Plant for his last employer, Corbett, Tinghir and Company, Inc., of New York. In addition to Corbett and Tinghir he was structural designer with the New York firms of Burns & Roe, Inc.; Byrne Associates, Inc., M. W. Kellogg Company, Inc., and the American Gas & Electric Service Corporation.

Fred M. Randlett (M. '18; F. '59), age 85, graduated from Tufts College in 1897, and by 1906 was assistant engineer with the Water Department of the City of Portland, Ore., followed in 1917 by promotion to the post of chief engineer. Thereafter, from 1925 until his retirement in 1950, he served alternately as Pacific Coast manager, director, and vice president and general manager of the Robert W. Hunt Company. More recently he had offered his services as an engineering consultant.

K. C. Spayde (A.M. '24; M. '59), age 67, a retired executive of the Bethlehem Steel Company in his capacity as contracting manager of the Baltimore Md., sales district through the years managed the contracts for the Chesapeake Bay Bridge, the Rappahannock River Bridge in Virginia, the Supreme Court Building and the annex to the House of Representatives Office Building. He began his career in 1916 with the McClintic Marshall Corporation, joining Bethlehem in 1935 when that company acquired McClintic Marshall.

Paul Jordan Stafford (A.M. '49; M. '59), age 47, for 20 years was employed by Kaiser Industries. In 1941, only two years after his graduation from the University of Santa Clara's College of Engineering, he was principal field engineer with the Kaiser Company, and by 1942 was in charge of the Engineering Section in the Oakland office of the Henry J. Kaiser Company. When he died recently, Mr. Stafford was chief estimator with Kaiser Engineers, Inc., in Oakland.

Harold W. Streeter (M. '23; F. '59), age 77, a pioneer in water pollution research, from 1942 to 1948—the year he retired—was director of the U.S. Public Health Service's Sanitary Engineering Center in Cincinnati. His career in the Public Health Service dated back to 1914 when he was a member of the first research group assigned to investigate the causes and methods of control of water pollution. In addition to conducting early studies on the ability of water treatment plants to produce safe drinking water from polluted lakes and streams Mr. Streeter contributed to the development of the Streeter-Phelps Oxygen Sag Formula. His last formal association with the Sanitary Engineering Center occurred in 1957 when he presented a paper for the seminar "Oxygen Relationships in Streams."

George E. Swannack, Jr. (A.M. '45; M. '59), age 45, during his entire engineering career of 23 years was affiliated with the Spokane, Wash., contracting firm of Charles A. Power as assistant superintendent and then general manager. For six years, 1940 to 1946, he served as a Colonel in the U.S. Air Command.

Elmer Mervin Ward (M. '47; F. '59), age 59, since 1954 assistant director of the National Academy of Sciences Highway Research Board, originally joined the academy as engineer of maintenance in 1946. During World War II he served with the Army Engineers' Road and Airfields Board at Fort Belvoir, Va.

Emil A. Weber (M. '42; F. '59), age 77, from 1942 until his recent death was president of the McMullen and Pitz Construction Company in Manitowoc, Wis., where he specialized in the design and construction of maritime structures, bridges, sub-marine utilities, docks and piers. For a 30-year period prior to joining McMullen and Pitz, Mr. Weber was chief engineer and secretary-treasurer with Greiling Bros.

George Weber, Jr. (M. '51; F. '59), age 57, at the time of his recent death was a partner in the Pennsylvania public utilities firm of Weber, Fick & Wilson. Professionally he was well suited to his role with a public utilities organization, having had a long and varied Federal career which included experience as assistant engineer with the Department of Forest and Water in the 1930's, followed by duties as assistant hydraulic engineer with the Department of Agriculture's Soil Conservation Service and as an advanced hydraulic engineer in charge of the Federal-State Flood Forecasting Service. Just prior to joining Weber, Fick & Wilson, he represented Gannett, Fleming, Corddry & Carpenter, Inc., as engineering consultant to municipal water and sewer authorities.

William Archie Weldin (M. '16; F. '59), age 80, when he died recently was in retirement, having formerly been a partner in the engineering firm of Blum-Weldin and Company in Pittsburgh, Pa. A graduate of the University of Pittsburgh, he served as an alumni trustee for two terms.

WHEN BUYING HYDRANTS LOOK FOR A MANUFACTURER WITH AT LEAST 100 YEARS' EXPERIENCE

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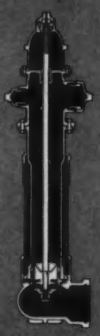

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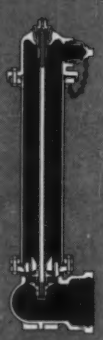
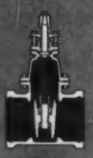
R. D. Wood Mathews Flange Barrel Hydrant . . . dry head construction keeps it operating in every kind of weather.



R. D. Wood Swivel Joint Hydrant can be faced in any direction.



R. D. Wood Gate Valve—bury it and forget it.

News of Members

(Continued from page 36)

William Roy Glidden, a Past President of ASCE, who retired a few years ago as assistant chief engineer of the Virginia Department of Highways after many years of service to that Department, has moved from Richmond, Va., to 414 South Fourth Street, Geneva, Ill. Mr. Glidden served as Society President in 1955, after earlier service as Vice President, 1951-1952, and Director, 1946-1948.

Harold R. Hutchens, having joined the Carter-Waters Corporation of Kansas City, Mo., in 1957, as a research engineer specializing in precast and prestressed concrete, recently became general manager of the company's extensive concrete products manufacturing facilities in that city. Before 1957 Mr. Hutchens was in private practice.

William C. E. Becker, a consulting engineer of St. Louis, Mo., and **Clarence H. Ax,** constructor and president of the Clarence H. Ax Construction Company, are among those named to the St. Louis Building Review Committee provided for in the city's new building code. Mr. Becker served as vice-chairman of the Building Code Committee which prepared the new code.

Harry Pawlowski, for the past nine years a civil engineer with the Chicago Department of Public Works, has advanced to the post of assistant chief water engineer.

Brooks T. Morris has been appointed to the newly-established position of special assistant for Reliability Assurance at the California Institute of Technology Jet Propulsion Laboratory. One of Mr. Morris' prime responsibilities will be to evaluate the overall practices of the Laboratory and its prime contractors. For the previous 13 years he was with the Marquardt Corporation, where, as director of the Propulsion Division, he had charge of missile engine development.

Lester A. Robb, an engineer from Carson City, Nev., has been on leave in the United States this past summer after two years in Cambodia as water resources adviser with the International Cooperation Administration, assisting the Cambodian Government to plan, design and construct irrigation systems. About the first of September, he departed for Morocco on a similar engineering assignment for the ICA.

Howard F. Clark, after nine years of service as chief engineer and general manager of the Chino Basin Municipal Water District, a component part of the Metropolitan Water District of Southern California, retired recently. In 1945 he left the Corps of Engineers with the rank of Colonel, serving subsequently with Greeley and Hansen of Chicago for several years prior to his work with the Water District. He will continue as a consultant on water matters.

Lawrence P. Frate who began his naval career in 1942 as a Lieutenant (jg) in the Civil Engineer Corps was recently promoted from Commander to Captain, NAS Public Works Officer in Japan. Before this he was in the Office of the Chief of Naval Operations; with the Construction Division of the Bureau of Yards and Docks; and as public works officer at the Naval Supply Depot in Bayonne, N.J.

Robert R. Jay, after several marketing and sales posts with the General Electric Company, is the new manager of product marketing in the Transistor Division of the Sprague Electric Company. His last position was as General Electric's district sales manager for semiconductor products in the Long Island, N.Y., area.

Wesley L. Orr recently returned to the campus of the University of California at Los Angeles to resume teaching there after four years at the International Cooperation Administration mission in Indonesia. Once again he will take up the duties of team leader and assistant dean of the University's engineering department. Professor Orr is one of several American professors sent by UCLA to help develop and strengthen the curriculum and facilities at Indonesia's Gadjah Mada University.

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This is Gateway Center Building No. 4 in Pittsburgh's Golden Triangle. It is supported by 647 Franki Pressure Injected Footings similar to the photo at the right. The unusually high carrying capacity of 120 Tons each is secured in forging the base, when the density of the subsoil is permanently multiplied by

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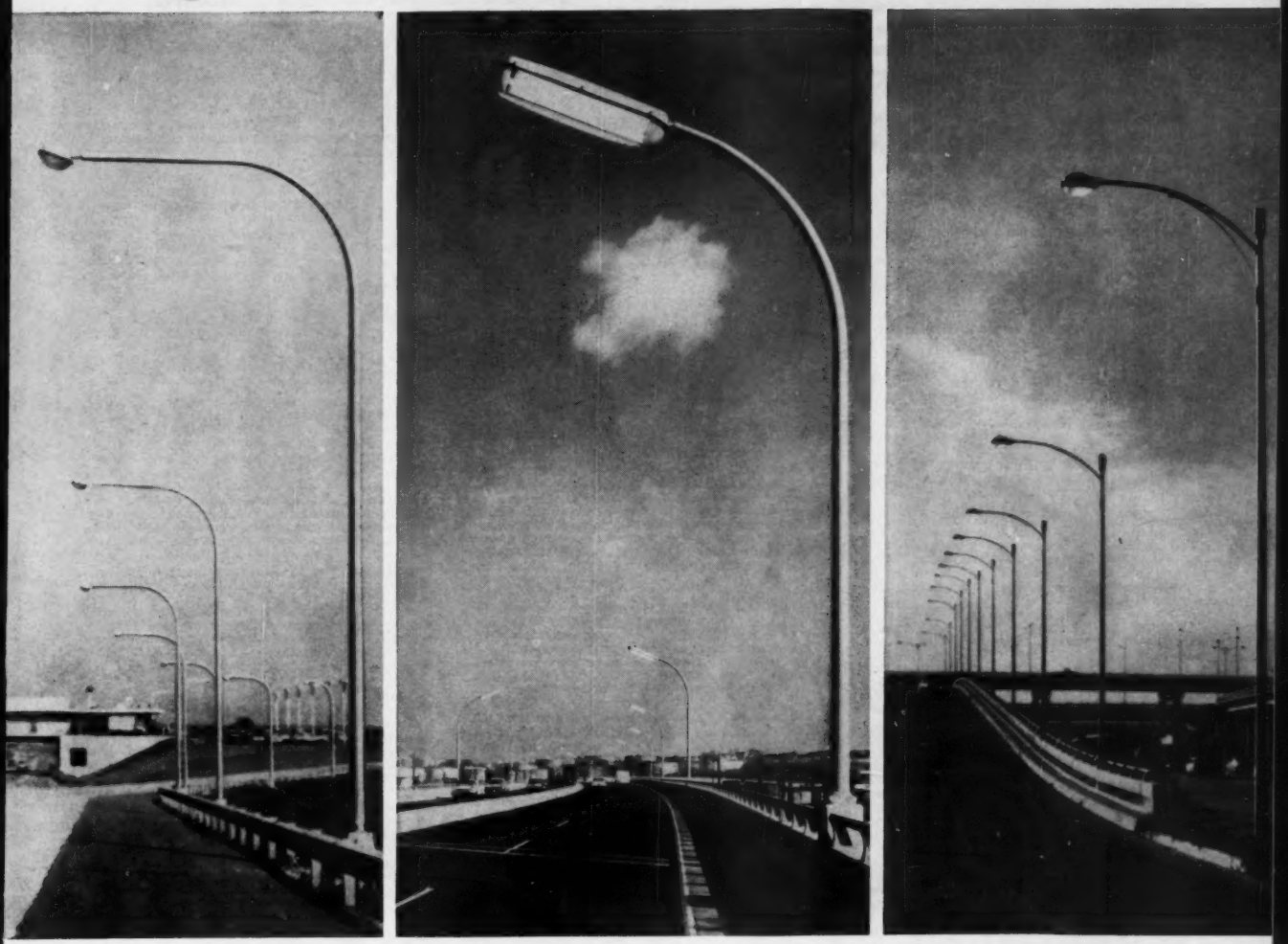

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These items are listings of the Engineering Societies Personnel Service, Inc. This Service, which cooperates with the national societies of Civil, Chemical, Electrical, Mechanical and Mining, Metallurgical and Petroleum Engineers, is available to all engineers, members or non-members, and is run on a nonprofit basis.

If you are interested in any of the listings, and are not registered, you may apply by letter or resume and mail to the office nearest your place of residence, with the understanding that should you secure a position as a result of these listings you will pay the regular placement fee. Upon receipt of your application a copy of our placement fee agreement, which you agree to sign and return immediately, will be mailed to you by our office. In sending applications be sure to list the key and job number.

When making application for a position include eight cents in stamps for forwarding application.

Men Available

DIRECTOR OF PUBLIC WORKS, PROJECT MANAGER, RESIDENT ENGINEER, M. ASCE, B.S. in C.E., Harvard-1934. Designed reinforced concrete structures with Bureau of Reclamation and Corps of Engineers in addition to 20 years' varied engineering and management experience in planning design, construction, maintenance and operation of major naval installations as officer in Civil Engineer Corps, U.S. Navy. Salary, $10,000. Location immaterial. C-712.

HIGHWAY OR TRAFFIC ENGINEER, M. ASCE, A.B., B.S.C.E., Certificate-Yale Bureau of Highway Traffic, P.E., New York State. Six and a half years with major public transportation authority engaged in all phases of planning, design, safety, control, and operation of vehicular facilities such as tunnels, bridges, airports, seaports; roads and approaches. Fluent Italian, French, Spanish. Location, Europe. C-713.

JUNIOR CIVIL ENGINEER, A.M. ASCE, B.C.E. One and a half years on field survey crews. Engaged in control surveys for photogrammetry and plane table mapping; including one half year as party chief. Also one year of experience on inspection of highway construction. Salary, $6,-500. Location, East. C-714.

DIRECTOR OR ASSISTANT DIRECTOR OF PUBLIC WORKS, ASCE, B.S.C.E., registered P.E., 39. Six years of teaching combined with private practice in municipal problems; five years of experience in administrative duties and preparation of plans and specifications for public works of which three were spent with a municipality. Location, East and South. C-715.

CIVIL ENGINEER, M. ASCE, M.S.C.E., 34. Five years with contractors, four years with consultant for highways, industrial and commercial structures (design and field supervision); some preliminary knowledge in traffic engineering, disposition to research work. Languages, German, French, English. Now in Europe. Location, East or West Coast or Europe. C-716.

CIVIL ENGINEER, M. ASCE, graduate Cambridge, U.K., 37, ex-Lt. Col. Experienced in design construction of airfields. roads, harbors. Also assistant professor of soils for two years, and in responsible charge of all naval civil engineering in India including international contracts for three years. Presently in U.K. Desires position anywhere in South America, Pacific Coast or Alaska. C-717.

CIVIL HIGHWAY ENGINEER, A.M. ASCE, B.S. C.E., U. of Iowa, 28. Experience in design of municipal highway facilities by the study of traffic requirements, development of the construction plans and cost estimation of the project. Construction supervisor as resident engineer for the completion of the facilities. Salary, $8,500. Location, Midwest. C2261-Chicago.

DESIGNER, A.M. ASCE, Registered EIT, 24. One year of experience in structural steel design and one year of timber design and research. Active duty-service obligation fulfilled. Salary, $7,-200. Location, Midwest. C-2262-Chicago.

STRUCTURAL DESIGNER, A.M. ASCE, B.S.C.E., 23. One and a half years as structural designer of steam and hydraulic power plants. Other experience includes one year as field engineer on heavy construction at Air Force base, and one year as structural draftsman for toll road bridges and restaurants. Salary, $7,200. Location, Illinois. C-2262-Chicago.

STRUCTURAL ENGINEER, M. ASCE, German Engineering Degree, Registered structural engineer in Illinois, 34. Ten years' professional, four years' sub-professional work in progressively responsible positions on heavy industrial and commercial building projects. Responsible charge of several complete industrial plants and other projects. Familiar with all phases of consulting project engineering and organizing. Salary, $11,000-$13,-000. C-2264-Chicago.

HIGHWAY ENGINEER, A.M. ASCE, B.S., M.S.C.E., 23. EIT, two years of varied experience in highway design and construction materials, research in soil stabilization for highway purposes. Good background in surficial soils. Salary, $8,000. Location, Midwest. C-2265-Chicago.

FIELD SUPERINTENDENT, M. ASCE, B.S.C.E., 28. Past four years spent supervising the erection and repair of steam turbo-generators and allied equipment. Salary, $8,000. C-2266-Chicago.

DESIGN ENGINEER, PROJECT ENGINEER, A.M. ASCE, B.S.C.E., Physics, 29. Experience in analysis, design of structures for nuclear power plant including containment structures, foundations for reactor plant machinery, shielding support and refueling problems, also handling problems connected with large nuclear plant components. Technical writing a requirement of present job. Salary, minimum $8,500. Will relocate anywhere except in the North. C-2267-Chicago.

PARTNERSHIP WITH ENGINEER AND/OR SURVEYOR, A.M. ASCE, B.S.C.E., Assoc. Sc. Land Surveyor, 27. For seven years was in partnership and/or branch office manager. Now desire position with older engineer and/or surveyor engaged in professional land survey work envolving title surveys, subdivision, development, etc. Salary, $8,500 minimum. Location, U.S.A.—Open. C-2268-Chicago.

CIVIL ENGINEERING SUPERVISOR—OFFICE, F. ASCE, M.S. (Structures), Registered Structural and P.E., 38. Field and office experience gained with consultant and industry includes municipal work, bridges, dams, refineries, offshore oil, buildings, and housing. Salary, $10,000-$12,000. Location, anywhere in U.S. C-2269-Chicago.

MANAGEMENT OR LIASON-CONSTRUCTION OR ELECTRONICS, M. ASCE, CE 38. Ten years of alert, management experience in basic engineering with background in consulting and construction, manufacturing management of building materials, sales, plant layout, design. Also knowledge of union negotiations, accounting and purchasing. Salary, $15,000. Location, Western U.S. Se-401.

FIELD, OFFICE-CONSTRUCTION, A.M. ASCE, CE, 29. For eight years in charge of design, estimating and construction supervision of buildings, paving, asphalting highways and in land and highway surveying jobs. Salary, $15,000. Location, foreign. Se-1051.

CONTRACTOR, A.M. ASCE, CE, P.E., California, 39. Experience includes design work and construction supervision plus the business and administrative experience acquired from operating my own engineering business for five years. Good background in fields of water supply industrial plants and land development. Location, open Se-1251.

DESIGN OR HEAVY CONSTRUCTION, M. ASCE, CE, 39. Thirteen years design, supervision subdivisions, city improvement, highway, hydraulics, small dams, transmission lines. Salary, $800 per month. Location, West. Se-1301.

PROJECT MANAGER, A.M. ASCE, ASME, CE, 32. After five years as project engineer experienced to perform overall planning and supervise construction of masonry buildings and steel towers; make plot plans and specifications; estimate approximate costs, negotiate contracts and maintain cost control; approve construction techniques and materials, schedule and co-ordinate contractors; and supervise inspectors and make periodic inspections, and acceptance. Salary, $9,000. Location, West, South or Mid-West. Se-1038.

INSTRUCTOR, RESEARCH-HYDRAULICS, M. ASCE, CE, MS IrrigE, 40. Seven years of experience teaching mechanics, fluid mechanics and hydraulics. Plus two years of research in mechanics and hydraulics. Salary, $8,500. Location, Western U.S. or foreign. Se-404.

FIELD, A.M. ASCE, CE, 25. Completing Air Force duty. Have done construction inspection and design. Salary, $575 per month. Desire work in Southwest U.S. but will relocate. Se-866.

SUPERINTENDENT CONTRACTOR, A.M. ASCE, MS CE, 24. One year as superintendent and engineer for general engineering contractor and two years designing dams and canals. Salary, $160 per month. Location, Pacific Coast. Se-1098.

Positions Available

CONSTRUCTION ESTIMATOR, civil graduate, with at least five years on take-off and pricing for excavation, foundation, structures, etc. on institutional projects. Salary, $7,800-$10,400. New York City. W-745.

HIGHWAY DESIGN ENGINEER, experienced in highway location and planning. Some knowledge of drafting desirable and other general municipal engineering experience. Salary open. Connecticut. W-744.

CONSTRUCTION MANAGER, graduate civil, with at least 10 years of experience in real estate development and construction of small concrete houses. Knowledge of Spanish and foreign experience desirable. Salary, $15,000-$18,000. South America. F-732.

BUILDING CONSTRUCTION SUPERINTENDENT, with at least 10 years of supervisory multi-story high rise reinforced concrete experience. Salary, $11,-700-$13,000. New York, N.Y. W-723.

CONSTRUCTION MANAGER, graduate civil, for a university engaged in a long range building program. Must have complete knowledge of construction, to represent the university on the construction sites. Will report to university architect. Excellent benefits program, including tuition programs for employee and family. Permanent. Salary, $8,000-$10,000. East. W-721.

SENIOR STRUCTURAL ENGINEER, must have PE license plus five years' experience dealing with apartment house construction. Will review structural plans, check shop drawings, inspect and test borings; also occasional field inspections and related duties. Salary, $9,030 to start, with increments. New York City. W-709.

CHIEF DESIGN ENGINEER, civil graduate, with at least 10 years' experience supervising project design in the sewage, water supply, irrigation and general municipal engineering fields. Must be American citizen. Salary, $15,000-$18,000. Headquarters in Europe with assignments in Mediterranean area, West Africa and Middle East. F-707.

CITY PLANNING ENGINEER, graduate civil, with eight years' experience including at least five years of community planning experience. Advanced degree in city planning recognized as an allowable substitute under general community planning experience. Must be licensed P.E. in New York State. Will be responsible for all broad scale city planning activities as well as serving as technical advisor to Planning Board, Zoning Board of Appeals, etc. Will be responsible for furnishing advice and information on population trends, economic factors and other related matters in connection with development, redevelopment and zoning problems. Salary to start, $11,480. Prefer residents of Westchester County, N.Y. as this is job location. W-701.

ENGINEERS. (*a*) Assistant Project Supervisor, Registered Architect or New York State P.E. license, with at least 10 years' building construction experience, to direct surveys on building structures, safety modifications, etc. Salary, $10,-000. (*b*) Senior Field Engineer, civil graduate, with at least five years' building construction experience, for inspection, field engineering and reports. Salary, $8,500. New York City. W-698.

ARCHITECTURAL DESIGNER with at least 10 years' experience on high rise buildings. Salary, $9,100-$10,400. New York, N.Y. W-689.

RESIDENT ENGINEER, civil graduate, with at least five years' highway construction experience including concrete pavement supervision, soils and materials testing and general pavement design. Latin American experience essential. Salary, $12,000-$14,400 plus 400 to 600 pesos allowance. Colombia, South America. F-688.

CONSTRUCTION INSPECTOR, civil graduate, preferably single, with at least five years' highway and airport construction experience for inspection and field engineering duties. Must speak French fluently with ability to pass a written and spoken technical interview. Salary, $12,000 U.S. currency, plus $4,000-$5,000 a year local

currency for subsistence, etc. Southeast Asia. F-685.

SALES ENGINEERS, C.E. or M.E. degree. Experience in road building and heavy earth moving field to act as representative of equipment dealers for a manufacturer of heavy earth moving equipment. Also promote and assist in sales promotion on job demonstrations as well as contact large road building and construction contractors and industrial users direct; travel by air, home week ends. Salary, $9,600 plus expenses; one man to work out of Chicago, one to work out of Atlanta; employer will negotiate placement fee. C-8816.

CHIEF ENGINEER, graduate C.E. To handle estimating, planning and procedures and all matters of engineering nature for contractor engaged in heavy construction work such as bridges, roads, pipelines and outside electrical construction. Will report to director of engineering. Salary about $15,000 depending on experience. Employer will pay placement fee. Chicago. C-8806.

OFFICE AND FIELD ENGINEERS for a consultant, graduate civil or sanitary. (*a*) Five or more years' experience in design, specification writing and field engineering on water and sanitation plants. Must be licensed engineer. Salary, $9,600-$10,800. (*b*) Junior Engineers, with three or more years' experience in design and field engineering on water and sanitation plants. Salary about $7,800. Colorado. C-8790.

FIELD, OFFICE CE, young. Several years' work on heavy construction for a large contractor, preferably with good aptitude for office engineering, contracts, specifications, progress, reports, materials, dealing with own forces, subcontractors and clients. Present assignment on large cement plant, later reassignment to other areas and better job. Salary, open. South California. Sj-6417.

DESIGN-CIVIL, STRUCTURAL, CE, Calif. Registration, to 45. Over seven years in responsible charge of commercial and industrial private and government buildings and structures. To head up San Francisco section for a consultant. Salary, open. Sj-6411.

ESTIMATOR-MULTISTORY BUILDING, CE, Arch, age open. Long, proven record estimates, cost analysis at project level on tall buildings (renderings to final take off) established knowledge methods, procedures, contracts, clients for New York office of engineer-builder on international hotels. Foreign (primarily European) contracts desirable. Salary $1,000. Sj-6473.

DESIGN-STRUCTURAL, graduate, possible Reg., 35-50. Compute, layout, design rigs for heavy weight lifting; determine stresses on frames, booms, purchase guys, anchors, cranes, hoists; (permanent or temporary A frames, gin poles rigging gear, framing, bracing, guying truck cranes, gautrys); medium to two hundred ton loads for leading heavy equipment contractor. Salary about $10,000. San Francisco East Bay. Sj-6294.

CITY ENGINEER, CE California Registration, U.S. citizen, age open. Three years' professional engineering experience required to assist City engineer in public works development, improvement. Knowledge of design, specifications, examination of field data, reports and ability to estimate examine, provide guidance desirable. Required to live in San Francisco. Salary, $850 per month. Sj-6400.

FIELD OR OFFICE ENGINEER, CE, young, with five years of experience in some of the following: heavy construction work on freeway, water front, dams, bridges, tunnels; excavate, concrete, equipment; field and board layout, check, inspect, expedite; contracts, subs, clients; costs, quantities, schedule, progress, plan. Western residents, changing sites. Salary, $500-$800 per month. San Francisco. Sj-6433.

CITY AIDE, CE accredited, young. About two years' experience, plus knowledge of structures, streets, storm drains, sub division work. Will compute, check, prepare plans and specifications, primarily assist in land usage (over twenty-two hundred new lots). U.S. citizens. For a young large San Francisco East Bay area city. Salary, $575-700 per month. Sj-6429.

This is only a sampling of the jobs available through the ESPS. A weekly bulletin of engineering positions open is available at a subscription rate of $4.50 per quarter or $14 per annum, payable in advance.

CHEMICAL RESEARCH ENGINEER

Chemical Engineer, MS preferred, with 3–5 years' experience, reporting to Manager of Research. To apply chemical engineering principles to the water and waste treatment field. Supervise and evaluate experimental work and prepare feasibility studies. New staff being recruited by nationally-known, progressive company.

Send resume and salary requirements to

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STRUCTURAL RESEARCH ENGINEERS

WE ARE SEEKING FOR OUR STAFF . . .

An experienced structural research engineer with creative ability to engage in applied and fundamental research. Also experimental stress analyst with management capability.

A UNIQUE OPPORTUNITY . . .

To perform diversified and stimulating studies of experimental and analytical nature in stress analysis, structural dynamics, plates and shells, and visco-elasticity. Salary will be in top bracket for outstanding engineers or scientists who qualify for these positions.

IF YOU HAVE . . .

A Ph.D. in Theoretical and Applied Mechanics or Civil Engineering (equivalent experience acceptable), with experience in structural dynamics, please send your resume to:

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All qualified applicants will receive consideration for employment without regard to race, creed, color, or national origin.

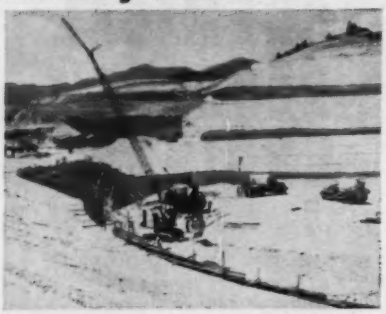
MANAGER of RESEARCH

Advanced degree in Sanitary or Chemical Engineering with 10 years' experience in water and waste treatment or related field. To direct R&D program of nationally-known progressive company. Will select own staff (ultimately 15 to 20). A man of recognized professional standing and administrative ability is required, to originate and apply new methods and procedures to the development of new processes and equipment designs.

Send resume and salary requirements to

Box No. CE 1002

NEW concrete forming method shapes Air Force Academy Stadium



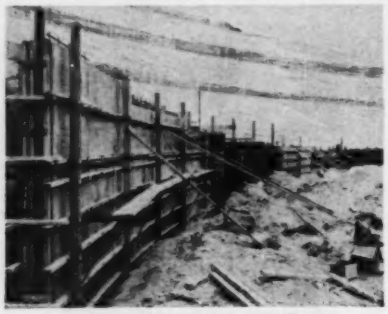
JAHN low-cost, PRECISION FORMING METHOD

saves time, labor, materials

Huge Falcon stadium, to seat 40,000 football fans at the Air Force Academy near Colorado Springs, Colorado, represented a major forming job for the B. H. Baker, Inc., construction company.

They solved the problem with JAHN Forming Brackets and loose ¾-inch 4x8 plywood panels, with standard 2x4 walers and double 2x4 strongbacks...all standard lumber yard materials.

JAHN low-cost, precision forming brackets are inexpensive, simple and easy to use. Forms can be set up to meet the most exacting architectural tolerance requirements, to any height, even curved walls.



NO NAILS REQUIRED—MAKES STRIPPING EASY AND QUICK

Quick, simple set-up and fast, easy stripping are features of the JAHN FORMING METHOD. Low cost, standard materials can be used over and over again, cutting costs to a very minimum.

In home-building and small apartment construction, ⅝-inch plywood panels are used for the forms, then utilized for sub-flooring or sheeting, eliminating the need to haul forming materials away from the job.

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Write or phone today for detailed information, prices and your nearest dealer for Jahn Precision Forming Brackets. Find out about the fastest growing, money-savin'est idea in the construction industry today. Phone SKyline 7-0301—or write—

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Applications for Admission to ASCE, August 5-September 2, 1961

Applying for Member

Robert Louis Alexander, Berkeley, Calif.
Grant J. Allen, Phoenix, Ariz.
David Clem Anderson, Kansas City, Mo.
John Lawrence Baer, Philadelphia, Pa.
Leo Kenneth Berry, Sacramento, Calif.
William Frederick Blank, Decatur, Ill.
Marvin Howard Breuer, Rolla, Mo.
Robert Auguston Burch, Raleigh, N.C.
Raymond John Dodson, Long Beach, Calif.
Clarence August Eckert, Wright-Patterson Air Force Base, Ohio
Edward Bohun Evans, London, England
David Lyman Garratt, Rochester, N.Y.
Felix A. Gonzalez, Caparra Heights, Puerto Rico
Angus Honore Griffin, Page, Ariz.
George Gross, Athens, Greece
Joseph Addison Harris, Richmond, Va.
Richard Elmer Harris, Patuxent River, Md.
William Vernon Hill, Kansas City, Mo.
Robert Leroy Houk, Memphis, Tenn.
Emile Huni, Vancouver, British Columbia, Canada
Ignatius Desmond Charles Imbert, Barbados, West Indies
Sidney Morris Johnson, New York, N.Y.
Albert Thomas Kersich, Billings, Mont.
Albert Joseph Kinast, Kansas City, Mo.
Philip Charles Kretschman, Ambler, Pa.
David Lim, Kuching, Sarawak
Walter Jay Linder, Sr., Dayton, Ohio
Garland Maurice Linton, Norfolk, Va.
George Calvin Love, Richland, Wash.
Albert Machlin, New York, N.Y.
Victor Kurt Mayer, Portland, Ore.
Robert Leo Micheels, Omaha, Nebr.
Joseph Avery Miller, Jr., Birmingham, Ala.
Glenn Merle Montgomery, Chicago, Ill.
Udo Nurme, Chicago, Ill.
Joseph Thaddeus Ozga, Los Angeles, Calif.
Henry Padleckas, Chicago, Ill.
Donald Andrew Parsons, Oxford, Miss.
John Sylvester Smith, Seattle, Wash.
Harry Sutcliff, San Francisco, Calif.
Howard Milton Taylor, San Diego, Calif.
Paul Treer, Rochester, N. Y.
Gustavo Vargas-Duran, Colombia, South America
William Jeptha Wall, Savannah, Ga.
David Arnold Weichert, Bloomfield, N.J.
Robert Henry White, Falls Church, Va.
David Wiesenfeld, New York, N.Y.
William Buttolph Wright, Millbrae, Calif.

Applying for Associate Member

Nabih Abder Rahman Abweh, Washington, D.C.
Robert Paul Adams, Harrisburg, Pa.
Arthur Basil Bradbury, Nottingham, England
Fernando De Casso Ortiz de Villajos, Madrid, Spain
Philip Aldrich Drinker, Cambridge, Mass.
Robert Goodwin Field, Boston, Mass.
Alberto Antonio Filos, Jr., Panama City, Panama
Jose Joaquin Godoy Orantes, Guatemala City, Guatemala
Lee Moon Hoe, Johore, Malaya
Joseph Charles Incandela, New York, N.Y.
Mahmoud Beshir Jamma, Denver, Colo.
Kunihiko Kawamura, Tokyo, Japan
George Stephen Korbay, San Francisco, Calif.
Mahmoud Osman Kuleib, Washington, D.C.
Pierre LaRochelle, Quebec, Canada
Ronald Walter Martin, Miami, Fla.
Edgar Alejandro Martinez-Navas, Managua, Nicaragua
Jack Donald McGee, Richmond, Va.
Balantrai Dhirajlal Mehtalia, University City, Mo.
Samy A. Mikhail, Lansing, Mich.
Sharadchandra Ramanlal Parikh, Middletown, Ohio
Eduardo Antonio Parra, Columbus, Ohio
Miguel Poole Perez-Pardo, Bilboa, Spain
Donald Boyden Ryder, Port Hueneme, Calif.
Sami Soydam, Ankara, Turkey
Dean Eldon Schuster, Kansas City, Mo.
Peter Sheffield, Toronto, Ontario, Canada
Ernst Olav Soyland, Van Nuys, Calif.
Joseph Nicholas Soboleski, Skykomish, Wash.
Victor Alberto Thomen Ribot, Ciudad Trujillo, Dominican Republic
Harold Edgar Wilkinson, Woodland Hills, Calif.
Allan Bartholomew Williams, Washington, D.C.
Robert George Williams, Oceanside, Long Island, New York
Karl Dale Willig, Independence, Mo.
Edward Herbert Zucker, Stanhope, N.J.

[Applications for the grade of Associate Membership from ASCE Student Chapter Members are not listed.]

Non-ASCE Meetings

American Concrete Institute. Fourteenth Regional Meeting at the Dinkler-Tutwiler Hotel, Birmingham, Ala., November 1-3, 1961.

American Congress on Surveying and Mapping. Arizona Southwest Regional Meeting at the Westward Ho Hotel, Phoenix, October 18-21, 1961.

American Institute of Consulting Engineers. Annual dinner at the Waldorf-Astoria Hotel, New York, N.Y., October 17, 1961. Contact T. T. McCrosky, Executive Secretary, AICE, 345 East 47th Street, New York 17, N.Y.

American Institute of Planners. National conference at the Statler Hilton Hotel, Detroit, Mich., November 26-30, 1961.

American Public Health Association. Eighty-ninth annual meeting at Cobo Hall, Detroit, Mich., November 13-17, 1961.

American Society of Mechanical Engineers. Annual meeting at the Statler Hilton Hotel, New York, N.Y., November 26-December 1, 1961.

American Society for Metals. Forty-third National Metal Congress and Exposition at Cobo Hall, Detroit, Mich., October 23-27, 1961.

American Society of Safety Engineers. Annual meeting in the Waldorf Room of the Conrad Hilton Hotel, Chicago, Ill., October 16, 1961.

Colegio de Ingenieros de Venezuela. Centennial in Caracas, October 21-28, 1961.

National Academy of Sciences-National Research Council. Tenth annual clay conference, sponsored by the Academy's Clay Minerals Committee, on the campus of the University of Texas, in Austin, October 16-18, 1961. Field trips are planned for Saturday and Sunday, October 14 and 15.

National Safety Council. Annual meeting at the Conrad Hilton Hotel, Chicago, Ill., October 16-21, 1961.

National Society of Professional Engineers. Fall meeting at the Hotel Roanoke, Roanoke, Va., October 19-21, 1961.

Prestressed Concrete Institute. National convention will be held in cooperation with the University of Colorado in Denver, Colo., October 15-19, 1961.

Purdue University. Conference on structural welding for engineers and architects on the Purdue campus, Lafayette, Ind., November 30 and December 1, 1961. Conference is being held in cooperation with the Indiana Steel Fabricator's Association.

Structural Clay Products Institute. Annual convention at the Shoreham Hotel, Washington, D.C., November 6-8, 1961.

Washington State University. Conference on Western Tidal Hydraulic Problems on the campus at Pullman, Wash., November 30 and December 1, 1961.

(Advertisement)

Progress Report on STEEL CONSTRUCTION

OCTOBER 1961

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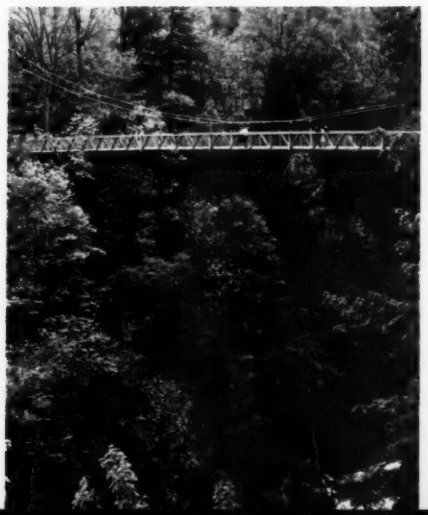
BETHLEHEM STEEL COMPANY

The smallest suspension bridge we've built



ITHACA, N.Y.—Sons of the Big Red will recognize this spot. It's the pedestrian crossing of Fall Creek gorge, at Cornell University, linking the area occupied by dormitories, fraternities, and sororities, on the north side, with the main campus on the south. It used to be spanned by an aged eyebar-chain suspension structure, with a 5½-ft-wide plank walkway. Now there's a new bridge—wider, stiffer, safer, and far more attractive.

Bethlehem bridgemen handled both dismantling of the old structure and fabrication and erection of the new one. The vital statistics: main span—270 ft; height of towers—41 ft; bridge deck—nine 30-ft panels topped with concrete-filled steel grid, 8 ft wide; stiffening trusses—4½ ft deep; main cables—2 in.-diameter strand hangers—⅞-in.-diameter wire rope at 30-ft centers.

The know-how that went into our smallest suspension bridge was acquired by Bethlehem Steel in nearly a century of bridge-building. During that time we've put up some real whoppers, including the famous Golden Gate and George Washington bridges.

Owner-designer: State of Oregon, Department of Highways; *general contractor:* Bethlehem Steel Company, Pacific Coast Division

Pacific panorama

NEAR BROOKINGS, ORE.—The combination of ocean, sky, rugged Oregon coastline, and soaring steelwork made this project a photographer's dream, but also helped make it something of a bridge builder's nightmare. For one thing, the superstructure is 'way up, with the roadway a dizzying 350 ft above the canyon floor. And to compound the peril, winds often whistle through the ravine in two directions at the same time. Note the use of safety nets.

The project is a two-lane continuous deck-truss bridge carrying U.S. Route 101, the Coastal Highway, over the gorge formed by Thomas Creek, a few miles north of Brookings. The steelwork extends 848 ft between abutments, with the longest span—385 ft—being at the south end. The superstructure is supported by two steel-frame towers rising from heavy concrete piers. The center span measures 185 ft.

The erection procedure called for all construction to proceed from the south side, using a stiff-leg derrick traveler, and cantilevering over falsework repeatedly. Beginning at the south abutment, Bethlehem bridgemen first erected out to a 15-ft-high falsework tower; then cantilevered to a tower 60 ft high; then, working from the cantilevered span, they built a third falsework tower 180 ft high. Erection of the bridge continued until the cantilevered deck arrived at a point where the derrick could hoist and place the steel for the south tower.

All falsework towers had to be capable of withstanding coastal winds up to 120 mph.

View from the ground, as bridgemen hitch up a tower leg to be set in place at the north tower. Note the derrick on the cantilevered deck high above.

The derrick traveler hoists a member as steelwork cantilevers far out from the south tower. Steel can be seen rising from the north pier at left. The thinner towers at right are falsework.

He's more than 300 ft up—and so was our photographer! An unusual look down one of the bridge towers.

Railroad in the basement!

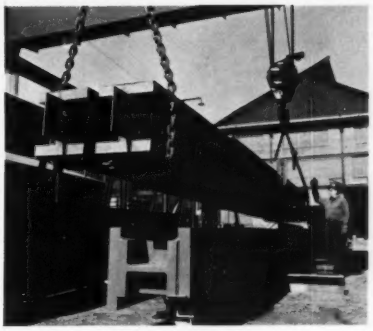
NEW YORK CITY—That's not an HO gauge model railroad. It's a New York Central express passing through the building site as Bethlehem ironworkers erect substructure steel for the Bankers Trust Building.

The 30-story building will occupy leased air space above two levels of operating tracks and rail yard areas. This situation, virtually unique to Manhattan, creates a multitude of problems requiring extraordinary know-how both in structural design and in construction methods.

The ultimate objective of the work shown in progress here was to found all columns for the office tower at street grade. This, in turn, required the construction of an elaborate and immensely strong substructure. In the process, Bethlehem crews had to place grillages 55 ft below grade, set substructure columns on them, and then erect ponderous built-up girders which are supported both by the columns and by existing underground steel framing. Highlights of this work are shown in the accompanying photographs.

Occupying the entire blockfront between 48th and 49th streets on the westerly side of Park Avenue, the building will rise 412 ft above grade. Its major tenant, Bankers Trust Company, will occupy some 60 per cent of the structure's 400,000-sq-ft total area.

Anybody have a shoe-horn? Bethlehem ironworkers are shown guiding the first steel grillage into position. This one weighed 7½ tons, and just cleared the underground columns.



Steelwork included these heavy girders shown being shipped from our Bethlehem Works. The upper one, a "double-header," comprises two 14-in. WF beams joined by 1½-in.-thick cover plates. The single-beam girder is a 14 WF 426 beam sandwiched between 3-in.-thick cover plates.

Owner-builder: Rose Associates; *co-general contractors:* Diesel Construction Company and Rose Associates; *designer:* Henry Dreyfuss, Industrial Designer; *architect:* Emery Roth & Sons; *structural engineer:* James Ruderman; *interior architects:* Shreve, Lamb & Harmon Associates; *mechanical engineer:* Jaros, Baum & Bolles; *foundation contractor:* Thomas Crimmins Contracting Co., Inc.

BETHLEHEM STEEL

Report from Constitution Plaza

HARTFORD, CONN.—The steel skeleton you see here is for 100 Constitution Plaza, the first major office building to be constructed at this city's 15-acre urban renewal project. Its 18-story framework was topped out in May by Bethlehem ironworkers.

Soon afterward they began raising the 20-story frame for another beauty—the Connecticut Bank and Trust Building. The architect's rendering indicates the finished appearance of this sleek structure.

DESIGN WITH A36 SAVES 150 TONS

The preliminary structural designs for the Connecticut Bank and Trust Company Building assumed the use of A7 structural steel. However, with adoption of the ASTM A36 specification, the engineers re-designed in the newly approved material with impressive results. They calculate a weight saving of about 150 tons, or approximately 1 lb per sq ft. Dollar savings for structural steel were roughly 6 to 7 per cent.

100 Constitution Plaza—
Associated architects: Charles DuBose, Emery Roth & Sons, Richard Roth; *architect for major tenant—Hartford National Bank and Trust Co.:* Jeter & Cook; *structural engineer:* James Ruderman; *mechanical and electrical engineer:* Joseph R. Loring Associates.

Connecticut Bank and Trust Company Building—

Architect for owner: Robert Allan Jacobs, Kahn and Jacobs; *architect for bank:* Carson, Lundin & Shaw; *structural engineers:* Weiskopf & Pickworth; *mechanical and electrical engineer:* Jaros, Baum & Bolles.

Owner-developer for the entire Constitution Plaza project: Constitution Plaza, Inc.;
general contractor: F. H. McGraw & Company.

BETHLEHEM STEEL

Owner: District of Columbia Armory Board;
architects and engineers: Dahl-Ewin-Osborn;
builders: McCloskey & Co.

Teamwork!

WASHINGTON, D.C.—A stiff-leg derrick steadies the upper arm of a welded box frame, while a long-boomed crawler crane hoists a ponderous steel strut into place. Elsewhere in the picture, dwarfed by the colossal steel shapes, welders are at work, and concrete workers prepare the footings for more steel.

That was the sort of teamwork that completed the District of Columbia Stadium for its autumnal occupants—the Washington Redskins. And, come next spring, the Senators will take the field.

The giant frames you see here are but a few of sixty-six, spaced at 30-ft intervals, that completely ring the stadium, supporting the roof and upper-deck seating. What's more, the frames vary in size, so that the seating rises higher in some areas than others, resulting in a novel undulating roofline. Unlike a conventional stadium, massive and static in appearance, Washington's has an airy, sculptured look that belies its monumentality.

The piece being lifted here is a 6-ton strut, measuring 30 ft by 8½ ft by 2 ft. It's being hoisted by an 80-ton-capacity crawler crane with 140-ft boom and 30-ft jib. The stiff-leg derrick, a 35-tonner with 90-ft boom and 15-ft jib, is mounted on an 85-ft-high tower.

The tapering frames are supported by two columns, pin-mounted on steel shoes. The frames' lower arms cantilever downward as much as 80 feet, and from them is suspended the steelwork for the press boxes. The 75-ft cantilever of the upper arms, connected laterally by wide-flange rafters, supports the roof.

Bethlehem bridges a building

Owner: State of New York, Department of Public Works; *consulting engineers:* Howard, Needles, Tammen and Bergendoff; *general contractor:* Gull Contracting Company, Inc.

Close-up of Bethlehem's method of moving inaccessible ends of the three big girders across portions of the substation. Girder rests on the winch-operated dolly. Hydraulic jacks in the foreground lowered the girder onto the bearing shoe at left.

BRONX, N.Y.—Small wonder it took four crawlers to lift that massive box girder—it's 131 ft long, 11 ft deep, and weighs 164 tons! In fact, it's the heaviest we ever fabricated at our Pottstown, Pa., works. Maneuvering it into place was the highlight of Bethlehem's work in supplying the superstructure steel for eight-tenths of a mile of Bruckner Expressway, a six-lane elevated link in the Interstate Highway System.

But the size of the girder is only part of the story. More unusual is the fact that it and two others had to be positioned directly over an electric substation that lies in the right-of-way, and could not be re-located.

What's more, a railroad cut and high-tension lines along the far side of the building prevented Bethlehem's erection crew from using crawlers to place that end of the girder on its pier. Instead, they put up three 60-ft-high falsework towers, ran heavy stringers over them, topped with a narrow-gage track on timber ties. A winch-operated dolly rode the track. Then came the fun.

First, the girder was raised by two 60-ton crawlers at the far end, and two 100-ton crawlers at the near end. Next, the far end was eased down on the dolly, and the near end was seated on a falsework tower. Then, as the 100-ton crawlers cautiously walked the near end (including the tower, for safety's sake), the dolly was winched along until the entire girder was perfectly positioned over the piers. Finally, two 100-ton hydraulic jacks picked the far end off the dolly, whereupon the huge piece was gently lowered into place.

Simple—when you know how.

Good neighbor bridge

SAULT STE. MARIE, MICH.—High above American soil, Bethlehem bridgemen are shown erecting truss members for the new International Bridge which, when completed, will be 14,595 ft long over-all, with a two-lane roadway elevated 124 ft over busy ship canals.

Bethlehem's contract includes the structure's most impressive portion, a four-span continuous double-arched truss unit with suspended roadway, with two main spans of 430 ft each, and 200-ft sidespans. Roughly 1,400 ft of three- and four-span continuous deck-plate-girder units will extend from the north end of the truss bridge to a pier just south of the International Boundary, where Canadian bridge builders take over.

We began erection at the south-end pier, cantilevering out successively to two lofty falsework bents, then to the southerly main pier. We used an 80-ton-capacity crawler with 150-ft boom and 20-ft jib to build the falsework, erect the traveler (25-ton-capacity with 90-ft boom) and then pass steel up to the traveler.

The erection scheme calls for the same operation to be repeated at the north end, working southward. Meanwhile, a guy derrick erected on the center pier set up two travelers to construct balanced cantilevers 215 ft in each direction. Finally, both spans were closed at their midpoints.

Although erection of the plate-girder spans is not as spectacular, it entails much heavier lifts—as much as 65 tons. The work requires an 85-ton-capacity traveler, aided by a 75-ton materials-handling derrick.

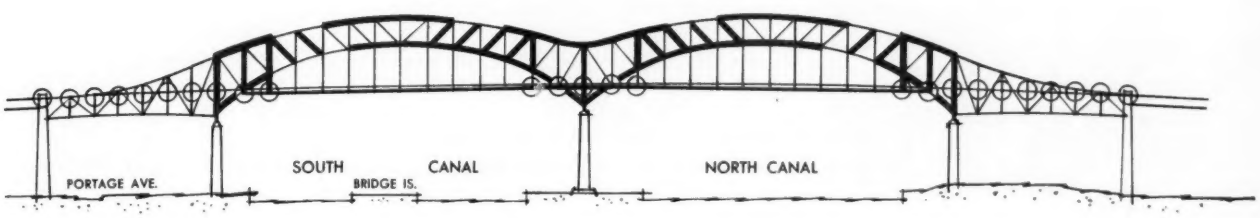
HIGH-STRENGTH STEEL SAVED 15 PER CENT!

It would be expected, of course, that the distinguished design engineers would produce an optimum design based on the criteria of adequacy, safety, beauty, and economy.

The use of ASTM-A440 steel for highly stressed truss members contributed substantially to achieving those goals. The profile sketch indicates the low-alloy truss members, most of which were built up of 15-in. channels with cover plates. All sidespan floor beams, 36-in. wide-flange shapes, varying in weight from 182 to 282 lb/ft, are also ASTM-A440 steel.

The engineers estimate that substitution of this high-strength material for A7 saved approximately 310 tons of dead weight in the American-side truss bridge, and about 170 tons in the Canadian-side three-span truss bridge. Approximate dollar savings were $185,135 and $94,940 respectively, for a total saving of $280,075, or about 15 per cent.

BETHLEHEM STEEL



Profile of four-span continuous arch-form truss bridge with heavy lines indicating use of ASTM-A440 steel in highly stressed verticals, diagonals, and chords. Circles indicate high-strength floor beams used in the suspended roadway. Low-alloy material was deliberately not used in sidespan truss members because to do so would reduce the weight to an undesirable level.

Owner:
International Bridge Authority of Michigan;
design engineer: the late D. B. Steinman;
supervision of construction: Steinman, Boynton, Gronquist & London, Consulting Engineers

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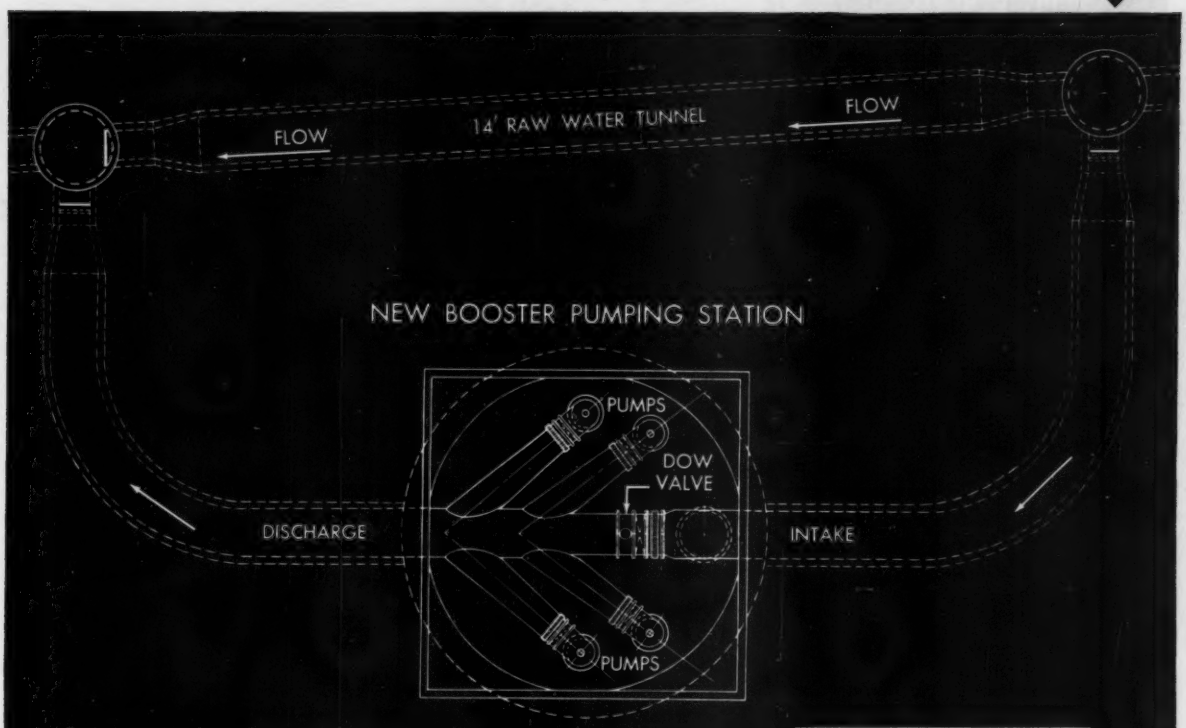

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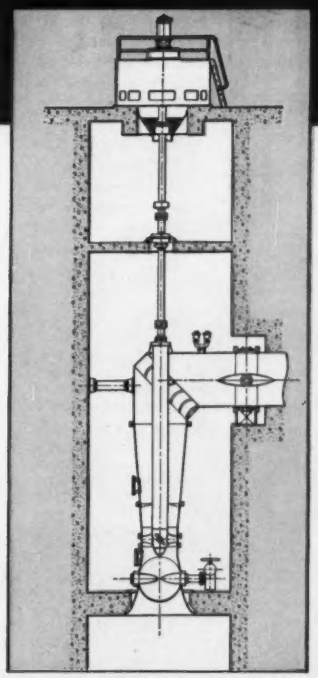

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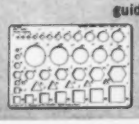

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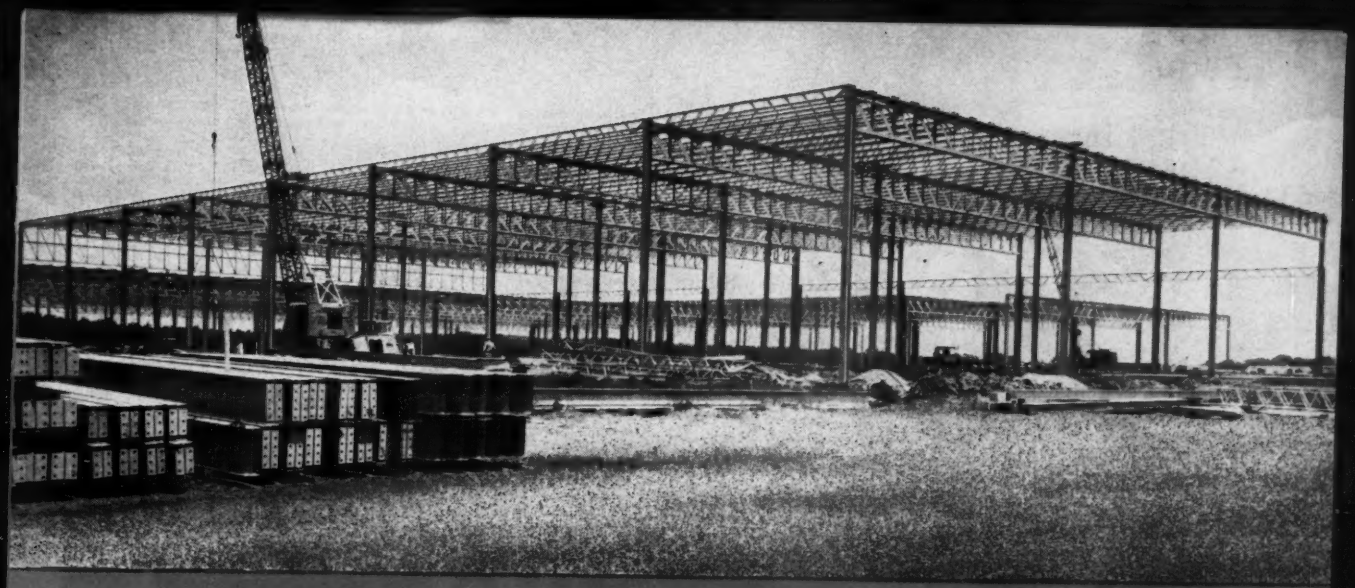
(Continued on page 128)



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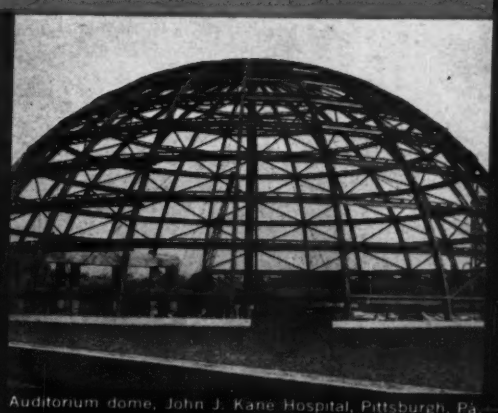
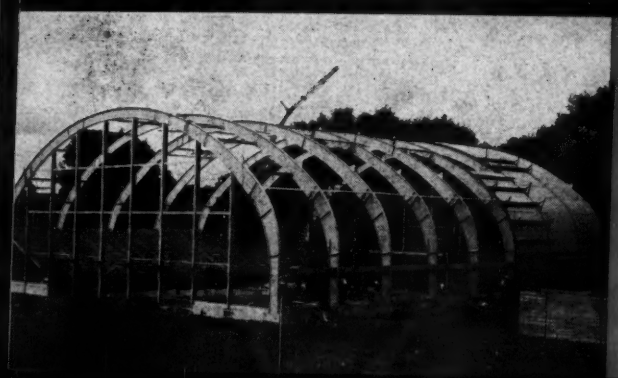


Auditorium dome, John J. Kane Hospital, Pittsburgh, Pa.



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flow is developed, and various applications of the theory are presented. New and unpublished results are included on porosity and permeability distributions in sedimentary rocks, and on the calculations of water sweep patterns. (By Royal Eugene Collins. Reinhold Publishing Corporation, 430 Park Avenue, New York 22, N. Y., 1961. 270 pp., bound. $12.50.)

The Impact of the Professional Engineering Union

The subtitle describes the book as a study of collective bargaining among engineers and scientists and its significance for management. It reports on the experiences of eleven companies where professionals have organized certified bargaining units. The three main sections discuss the impact on compensation, on personnel administration, and on the engineering organization. Appendix A is a compilation of existing unions representing engineering and technical employees. (By Richard E. Walton. Graduate School of Business Administration, Harvard University, Soldiers Field, Boston 63, Mass., 1961. 419 pp., bound. $5.00.)

International Association for Bridge and Structural Engineering, Memoirs

Volume 20

This 20th compilation contains 18 papers, 12 of which are in English. Approximately half of the papers deal with analysis of structural frames or with shell structures. Other topics include calculation of pile groups, vibration of foundations, bridge loadings, and relaxation of steel wires. English, French, and German summaries are provided for each paper. (Published by the General Secretariat of the Association, Zurich, Switzerland. 1960. 414 pp., paper. No price given.)

Introduction to Engineering Mechanics

The fundamentals of mechanics are emphasized in this work which differs from similar texts in its selection and sequence of topics. The author has divided the subject on the basis of particles, rigid bodies, and deformable bodies, as opposed to the traditional separation of statics and dynamics that makes little mention of deformable bodies. In addition a general vector algebra is developed and vector notation is used freely for those parts of the theory in which such notation seems advantageous. (By John V. Huddleston. Addison-Wesley Publishing Company, Inc., Reading, Mass., 1961. 493 pp., bound. $9.75.)

Oscar Faber's Reinforced Concrete

Second Edition

The basic theory and practical applications of reinforced and pre-stressed concrete are presented. This edition which contains new chapters on slabs, retaining walls, and concrete roads also includes substantially expanded chapters on the elements of reinforced concrete design, on foundations, bunkers and silos, shell-concrete roofs, water towers, reservoirs and prestressed concrete. Numerous examples, design curves, and diagrams have been added. (By John Faber and Frank Mead. D. Van Nostrand Company, Inc., 120 Alexander Street, Princeton, N. J., 1961. 532 pp., bound. $14.75.)

Pore Pressure and Suction in Soils

This volume contains the proceedings of a conference held in London in 1960 which was organized by the British National Society of the International Society of Soil Mechanics and Foundation Engineering. The 17 papers covering general principles and laboratory measurements; earth dams, embankments, and foundation; and roads and runways; and agricultures, are given in English and French. (Published by Butterworth, Inc., 7235 Wisconsin Avenue, Washington 14, D.C., 1961. 151 pp., bound. $11.25.)

Power from Water

The development of hydro-electric power in Great Britain is traced from its beginnings to the current large installations. The technical advances in methods and machines for hydro-electric production that have taken place recently are outlined, and the economics of hydro-electric power in relation to other basic sources of electrical energy is discussed. The prospects of its future application and further development conclude the book. (By T. A. L. Paton and J. Guthrie Brown. Leonard Hill (Books) Ltd., London, England, 1960. 210 pp., bound. 25s.)

Prestressed Concrete

A comprehensive treatment of the theoretical and practical aspects of analysis, design, and construction in prestressed concrete. The first part of the book is devoted to a presentation of the basic concepts and a step-by-step development of the principles of flexure analysis. This is followed by a detailed treatment of flexure analysis as it is applied to the design of structural members. Finally, the practical considerations of prestressed concrete are discussed. (By James R. Libby. The Ronald Press Co., 15 East 26th Street, New York 10, N. Y., 1961. 468 pp., bound. $12.50.)

Radioactive Wastes

The first half of this volume is fundamental in nature and explains the problems which need to be understood when dealing with radioactive material. The second half deals specifically with the treatment and disposal of liquid, solid, and radioactive wastes. It includes information on the results of laboratory work, and on the experience gained in operating treatment plants in different parts of the world. (Edited by J. C. Collins. John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N.Y., 1960. 239 pp., bound. $8.00.)

Source Book of the New Plastics

Volume 2

Developments in the plastics industry include the continuing appearance of new materials and new processes. This second annual review of such new developments presents the significant information on the important new plastics—properties, production, price, application and selection—as well as two chapters which discuss progress in technology, and new processes and applications. Information on new materials has been supplied by the producers themselves, and four leading plastics journals each supply an article giving their views on the most important recent developments. Also included is a survey of current federal-sponsored research in plastics. (Edited by Herbert R. Simonds. Reinhold Publishing Corporation, 430 Park Avenue, New York 22, N. Y., 1961. 310 pp., bound. $8.95.)

Water Treatment for Industrial and Other Uses

Second Edition

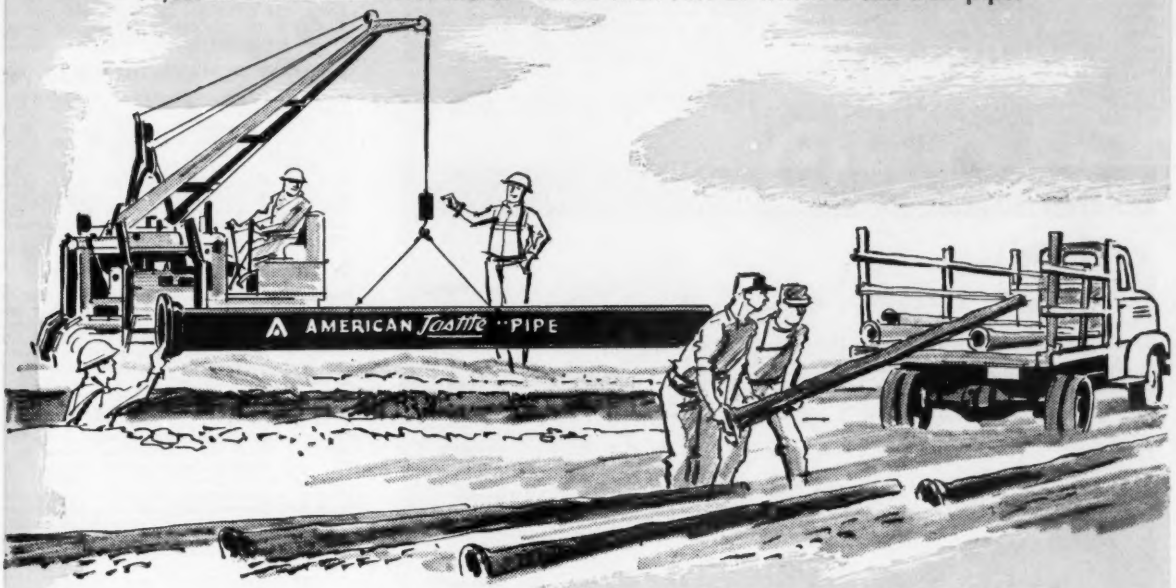
An extensive discussion of the conditioning and treatment of water supplies for industrial and domestic uses. The material in this edition has been considerably enlarged and rewritten with a view to including many advances within the field and to clarify the presentation where necessary. In particular two new chapters have been added which deal with commercial and institutional water conditioning and with municipal water conditioning. The material dealing with silica removal has been rearranged in a more logical fashion. (By Eskel Nordell. Reinhold Publishing Corporation, 430 Park Avenue, New York 22, N.Y., 1961. 598 pp., bound. $12.00.)

Library Services

Engineering Societies Library books, except bibliographies, handbooks, and other reference publications, may be borrowed by mail by ASCE members for a small handling charge. The library also prepares bibliographies, maintains search and translation services, and can supply a photoprint or a microfilm copy of any items in its collection. Address inquiries to R. H. Phelps, Director, Engineering Societies Library, United Nations Plaza, 345 East 47th Street, New York 17, N. Y.

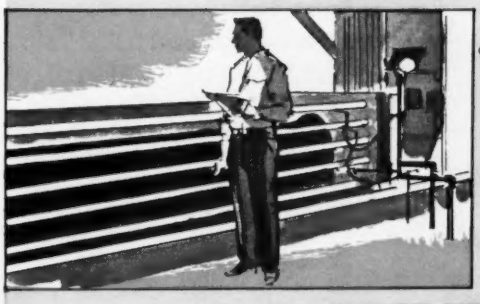
PIPE FACTS

The 100 largest cities in the United States, surveyed recently, have more than 95,000 total miles of water mains — more than 90% of which is cast iron pipe!



DO YOU KNOW that when larger distribution mains are needed, the smaller mains can be reclaimed for years of additional service...if they are cast iron?

In Reading, Pa., for example... seven miles of cast iron pipe was taken up and relaid – saving about $350,000. Rarely, if ever, is composition pipe taken up and re-used.



DO YOU KNOW that cast iron pipe is designed to withstand expected water hammer shocks which can burst weaker mains? In tests, it required 3,400 psi water pressure to burst 6" Class 150 AMERICAN pipe. Composition pipe of similar size and class failed at 770 psi.

DO YOU KNOW that industry requires large volumes of water...and it must be economical? For most new industrial plants, water is the most important natural resource needed. In the long run, cast iron pipe delivers water cheapest of all.

DO YOU KNOW that the AMERICAN Fastite Joint requires no calking? Its only joint component is a dual hardness, easily-inserted, double-sealing rubber gasket. A minimum of labor and equipment is needed to install Fastite pipe...and the extra minutes saved soon total up to additional dollars saved in installation costs.

*Patented conductive gasket

AMERICAN CAST IRON PIPE COMPANY
BIRMINGHAM ALABAMA

CATALOG DIGESTS of ENGINEERING and INDUSTRIAL interest

Bearings & Expansion Plates

1 COLUMBIUM-BEARING STEELS

Inland Steel Company—This booklet contains comprehensive information on high-strength columbium-bearing steels. The steels are furnished on the basis of minimum yield point (namely 45,000; 50,000; 55,000; and 60,000 psi). Included in the description are typical engineering properties, chemical composition, mechanical properties, cost comparison formulae and case history information.

2 KON-X BEARING PADS

Keasbey & Mattison Co.—A data page is offered describing bearing pads composed of asbestos fibers in combination with a synthetic rubber elastomer. They are ideal as pads under prestressed concrete beams placed over abutments. Resiliency is maintained despite extremes in temperature. The data page details other uses as well as physical parameters.

PLEASE PRINT NAME CLEARLY

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NOT GOOD AFTER NOVEMBER 15, 1961, for readers in the U. S., but requests will be accepted to December 29, 1961, from readers outside of this country.

3 LUBRITE EXPANSION PLATES

Merriman Bros., Inc.—This literature provides information about Lubrite Expansion Plates and Bushings with typical suggested design details and technical data. The bearings are completely self-lubricating and do not require periodic maintenance or servicing.

4 EXPANSION PLATES—SELF-LUBRICATING

Spadone-Alfa Corp.—Literature providing complete information covering Metaline oilless self-lubricating expansion plates and bridge bushings; also, Metaline bearings for underwater installations as found in dam and hydro-electric projects. Metaline products fully meet all federal and state requirements covering this type of material. This exclusive lubricant assures long, dependable service in heavy load, high temperature, submerged and corrosive applications.

5 SELF-LUBRICATING BEARINGS

Merriman Bros., Inc.—Manual No. 56 is a 24-page book containing information, technical data, and specifications about Lubrite self-lubricating bushings, bearings and washers for industrial equipment, machinery, hydro-electric, high temperature missile and atomic applications.

6 BEARINGS—OILLESS SELF-LUBRICATING

Spadone-Alfa Corp.—This literature describes Metaline Oilless Self Lubricating Bronze Bushings and Wear Plates for industrial and mechanical applications. Exclusive pre-molded lubricant assures dependable service under heavy load, high temperature, submerged and corrosive conditions. They are custom made in a wide variety of bronze alloys to meet the specific duty and application.

7 EXPANSION PLATES & BUSHINGS

Merriman Bros., Inc.—Manual No. 55 contains complete information, technical data and specifications about Lubrite self-lubricating expansion plates and bushings for bridges, building, refinery equipment, chemical processing equipment, high temperature missile and atomic applications.

Bridge Decking

8 BRIDGE DECK FORMS

United Steel Fabricators—This 4-page leaflet describes and illustrates improved methods for forming bridge decks without changing the design of the floor slab. Bulletin No. 1 offers supplementary designs for deck forms for prestressed concrete beams or girders and for steel beams or girders with shear connectors.

9 BRIDGE DECKING

Irving Subway Grating Co., Inc.—The 12-page catalog on Irvico Decking for bridges contains illustrations, descriptions and engineering data on metal grid bridge flooring, including the special beam type decking and the new C-K surface. It points out the features which include light weight, cleanliness, drainage, safety, durability, traction, strength and economy.

10 BRIDGE FLOORING

United Steel Fabricators—An 8-page pamphlet is offered on the design, specifications and step by step erection of structural-plate bridge flooring. This versatile product is now available in either painted or galvanized finish.

Concrete Construction

11 CONCRETE CONSTRUCTION

Richmond Screw Anchor Co., Inc.—A handbook, consisting of 12 bulletins of between 4 and 24 pages each, enclosed in a loose-leaf bind cover is offered. This handbook has a cross index for products and types of construction and contains forming details and technical data.

Use This Free Service—Mail The Coupon To-day

12 LIQUID RETARDER

Johns-Manville Cement Additives Unit—A 16-page technical bulletin is offered on Retardwel, a retarding admixture for concrete. Architects, engineers and others concerned with construction will find the data and reports of interest. They show how Retardwel aids in overcoming problems that are inseparable elements of any hot weather concreting operation. Retardwel permits a reduction in the water required for proper placing and therefore provides the advantages that are inherent in concrete fabricated with a minimum paste content. Its use delays the initial set of concrete and provides a slower rate of heat evolution, thereby minimizing thermal stresses.

13 SIMPLE-SPAN BEAM

John A. Roebling's Sons Division The Colorado Fuel & Iron Corp.—Engineering Bulletin PC-946 is entitled "Design Procedure for a Simple-Span Prestressed Concrete Beam." Its contents are based on ACI-ASCE Committee 323 report "Tentative Recommendations for Prestressed Concrete." It is an excellent guide for engineers designing prestressed concrete members.

14 POZZOLITH, MASTERPLATE AND EMBECO

The Master Builders Company—Two 1961 catalogs, one general and the other industrial, contain performance data and guide specifications for Master Builders products for the improvement of concrete and mortar. Some of the products included in these booklets are: Pozzolith, for the positive control of concrete quality; Masterplate, for longer-lasting concrete floors; Embeco, for non-shrink grout, concrete and mortar; and Omicron Mortar-proofing, for control of mortar qualities.

15 CONCRETE—EXPOSED AGGREGATE

Sika Chemical Corporation—Information on retardant form coatings for exposed aggregate finishes on concrete surfaces. Retardant is available in three forms. Rugasol C—sprayed directly on concrete, Rugasol F—form coating and Rugasol Cloth—applied as a form lining. Technique may be used to produce decorative architectural finishes or for structural applications to provide clean aggregate surface with high bond and excellent shear resistance.

PLEASE BE PATIENT
YOUR REQUESTS TAKE TIME

16 CONCRETE WATER REPELLENT

A. C. Horn Companies—A powder or liquid integral concrete water repellent, called Hydratite, is described in a 6-page folder. The detailed construction and testing of a cube with this material and mixing specifications are also included.

17 AIR ENTRAINING METER

Charles R. Watts Co.—A folder is available covering admixtures and air entraining agents and describing the Press-Ur-Meter, a device for determining the air content of fresh concrete. Said to be extremely fast, the Press-Ur-Meter follows the Klein-Walker application of Boyles Law, simplifies the usual testing procedure, using only about one tablespoonful of water, which is added on top of the sample to insure accuracy, the manufacturer reports. No adjustments for varying barometric pressure are necessary.

18 LIQUID CONCRETE ADMIXTURE

Johns-Manville Cement Additives Unit—A 32-page catalog is available on air-entraining Placewel, which when added to the mix, produces outstanding properties in the plastic and hardened concrete. It will yield from 3 to 6% of entrained air, while reducing the water-cement ratio for a given consistency by 15%, in any properly designed concrete mix. When added to a concrete of given consistency, it will provide marked improvement in workability and placeability; greatly increase compressive strength and durability while reducing bleeding and segregation. Non air-entraining Placewel is a straight liquid, water-reducing agent which, when added to concrete, greatly improves workability, durability and strength.

19 CONSTRUCTION MATERIALS TESTING

Forney's Inc., Tester Division—announces a 6-page general bulletin describing briefly a complete line of compression and universal testing machines for concrete, concrete products, and reinforcing bars. A reply card is mailed with the bulletin offering a complete catalog and general price list.

(continued on page 142)

This is the cooler that pioneered a trend

Just a little over a year ago no one ever saw a cooler like this. We call it the Wall-Mount, truly a Halsey Taylor first.

It mounts on the wall . . no exposed fittings, no space behind cabinet to catch dirt or grime! Off the floor . . room underneath for easy cleaning! The answer to maintenance-free installation and, like all Halsey Taylor fixtures, gives years of trouble-proof service.

The Halsey W. Taylor Co., Warren, Ohio

The Wall-Tite, big brother to the Wall-Mount. Fits tight to the wall.

Halsey Taylor®

Write for latest catalog, or see Sweet's or the Yellow Pages

THIS MARK OF LEADERSHIP IDENTIFIES THE MOST COMPLETE LINE OF MODERN DRINKING FIXTURES

163

You get CUMULATIVE RUST PROTECTION if all three coats are made with PERMOX® 1-4-3

(one-for-three)

Permox 1-4-3, Basic Lead Silico Chromate, is an effective, anti-corrosive pigment especially designed for all three paint coats . . . with rust inhibition in every coat! When used in all coats, maximum protection against rust becomes *cumulative*, each coat minimizing the possibility of corrosion arising from skips and holidays during application. More significantly, with Permox 1-4-3 it is now possible to obtain an anti-corrosive finish coat which permits the use of the same paint for spot priming and finishing.

Permox 1-4-3 is also characterized by excellent chalk resistance and low tinting strength. These qualities make possible the production of durable maintenance paints in an almost unlimited range of colors without sacrificing anti-corrosive qualities.

Suggested formulations for a wide variety of anti-corrosive and decorative paints designed for specific needs are yours for the asking. We welcome inquiries.

Permox 1-4-3 Conforms to ASTM Specification D-1648

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The Fabulous Ohio River Development

see story on following three pages . . . . . .

LOUISVILLE, KY.

Reconstruction of Lock No. 41 located 607 miles below Pittsburgh. This is a complicated job involving four cofferdams: Two main cofferdams, upstream and downstream and two guardwall cofferdams upstream and downstream. A total of 99 cells was constructed using 10,850 tons of USS MP 101 and MP 112 Piling in various lengths from 24 feet to 60 feet. General contractor—Hardaway Contracting Co., Columbus, Ga., under supervision of Louisville District, U. S. Corps of Engineers.

MARKLAND, IND.

Lock and Dam No. 39. Located 531.5 miles below Pittsburgh. Will replace five outmoded navigational facilities. One main lock 1,200 feet long by 110 feet wide and one auxiliary lock 600 feet x 110 feet. Dam gates are 42 feet high by 100 feet long. Lock cofferdam is 3,250 feet long, 50 feet high and contains 8,000 tons of USS Steel Sheet Piling. Lock construction recently completed by Dravo Corporation, Pittsburgh, Pa., under supervision of Louisville District, U. S. Corps of Engineers.

Between Greenup and Louisville . . . Four huge locks and

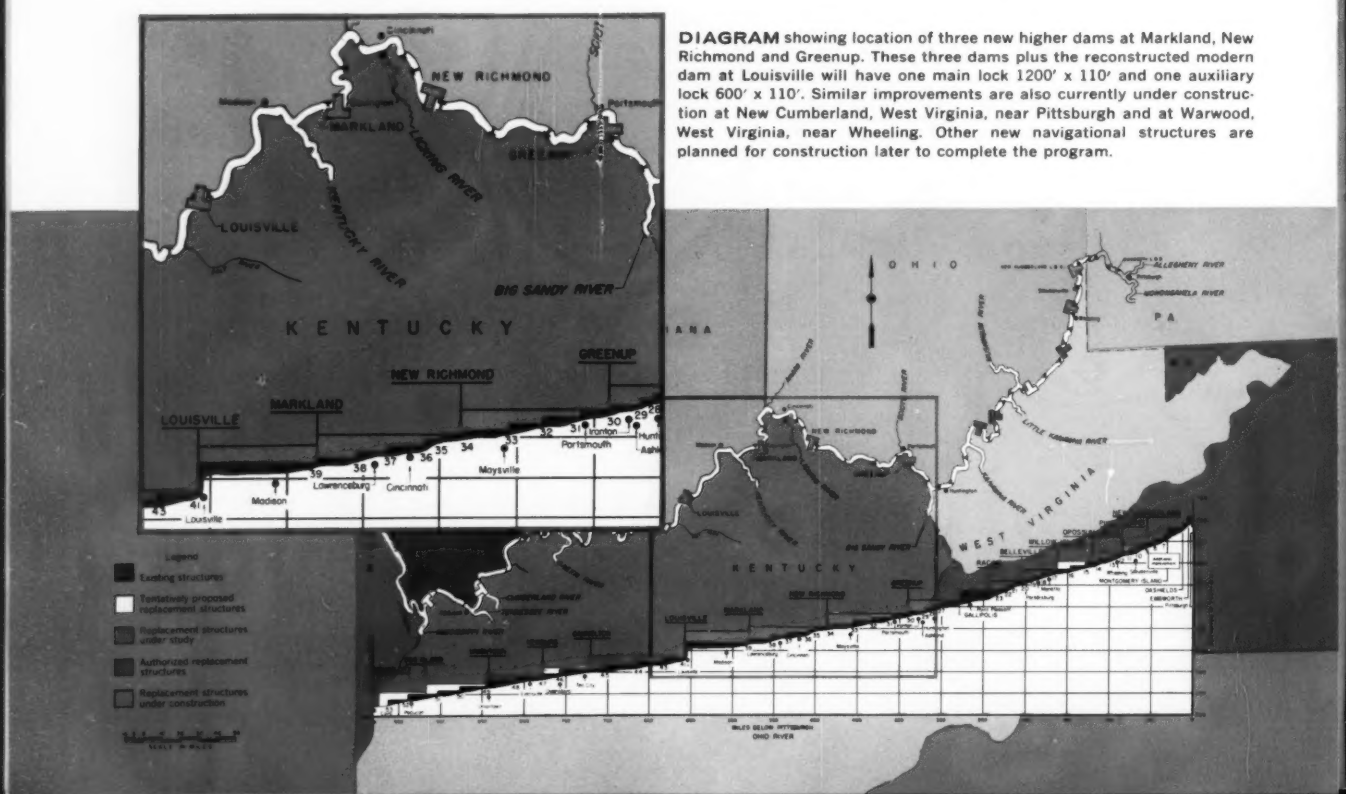
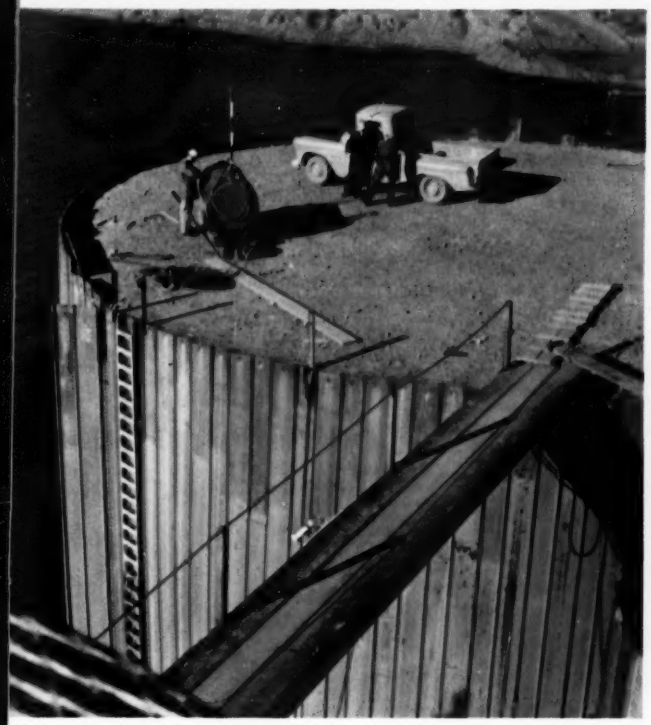


DIAGRAM showing location of three new higher dams at Markland, New Richmond and Greenup. These three dams plus the reconstructed modern dam at Louisville will have one main lock 1200′ x 110′ and one auxiliary lock 600′ x 110′. Similar improvements are also currently under construction at New Cumberland, West Virginia, near Pittsburgh and at Warwood, West Virginia, near Wheeling. Other new navigational structures are planned for construction later to complete the program.

NEW RICHMOND, OHIO

Lock and Dam No. 34. Located 436.2 miles below Pittsburgh. Will replace four older structures. Two locks same size as those at Markland but the dam gates will be only 37 feet high. The lock cofferdam contains 13,465 tons of steel sheet piling and has a total of 56 cells. Maximum length of piling 84 feet. Cofferdam construction by Peter Kiewit, Omaha, Neb.; lock construction by Groves Ventures Company, Minneapolis, Minnesota, under supervision of Huntington, W. Va. District, U. S. Corps of Engineers.



GREENUP, KY.

Lock and Dam No. 30. Located 341 miles below Pittsburgh. Replaces four older structures. Two locks of the same size as Markland. Dam gates will be 37 feet high. The lock structure has been completed by Atkinson-United Companies. A total of 10,194 tons of steel sheet piling was used. Much of this was USS Steel. Lock chamber cofferdam by Dravo Corporation of Pittsburgh, dam and cofferdam by Massman Construction Co., Kansas City, Mo., under supervision of Huntington, W. Va. District, U. S. Corps of Engineers.

dams will replace 14 outmoded structures

USS Steel Sheet Piling is used in the cofferdams

The growing industrial development in the Ohio River Valley has boosted river traffic to more than ten times what it was 30 years ago. Today it is more than 17 billion ton-miles. Barge tows are longer and many have to be broken up every time they go through the old 600-foot locks.

To speed traffic, the billion dollar Ohio River navigation replacement and improvement program is now in full swing under the direction of the Ohio River Division Office of the Corps of Engineers at Cincinnati, Ohio.

The entire program includes replacement of the present 46 navigational structures with 19 modern facilities. It is estimated that when the program is completed, about 1975, two full days' locking time will be cut off the average running time from Pittsburgh, Pa., where the Ohio River begins, to Cairo, Illinois, where it enters the Mississippi.

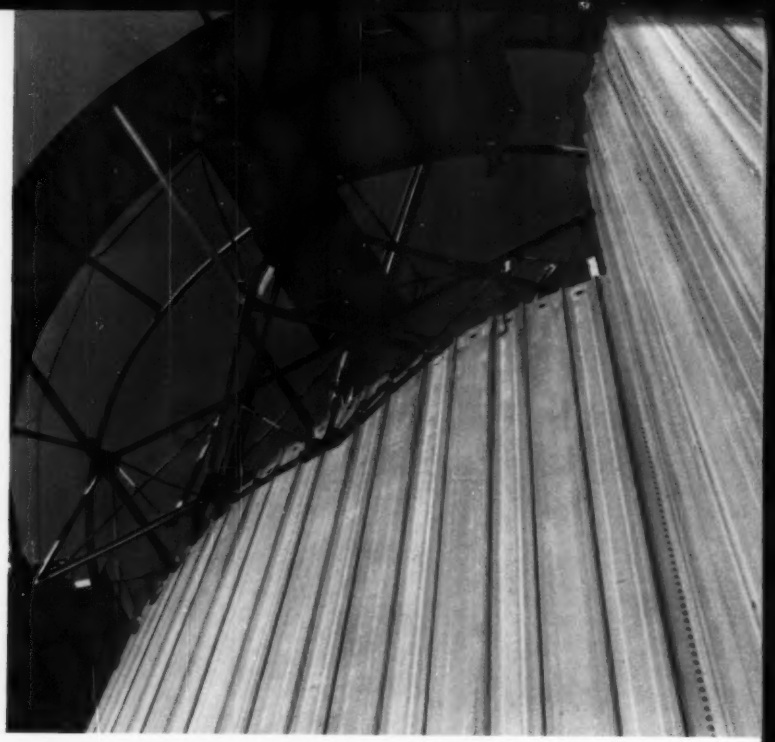
In this stretch of river, between Huntington, W. Va., and Louisville, Ky., huge new locks 1200 feet long and 110 feet wide are going in at Greenup, Ky., New Richmond, Ohio, Markland, Ind., and Louisville, Ky. Three new non-navigable dams, built higher to maintain the nine-foot minimum navigable depth, will take the place of 13 old structures in this 300-mile stretch.

One of the first major jobs is to build steel sheet piling cofferdams to dry up the work areas. Thousands of tons of U. S. Steel Sheet Piling are being used in these temporary cofferdams. A large quantity of USS Sheet Piling is also incorporated into the permanent lock structures. U. S. Steel's production capacity insures ready availability of all popular piling sections and makes possible quicker deliveries to each of the job sites. This capacity is advantageously located to provide shipment by various means—in this case by economical water transportation. In addition to steel sheet piling, hundreds of tons of USS Steel H-Piles are being used to support major portions of the structures including the guard and guide walls and in some cases the dam structures.

United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Export Company

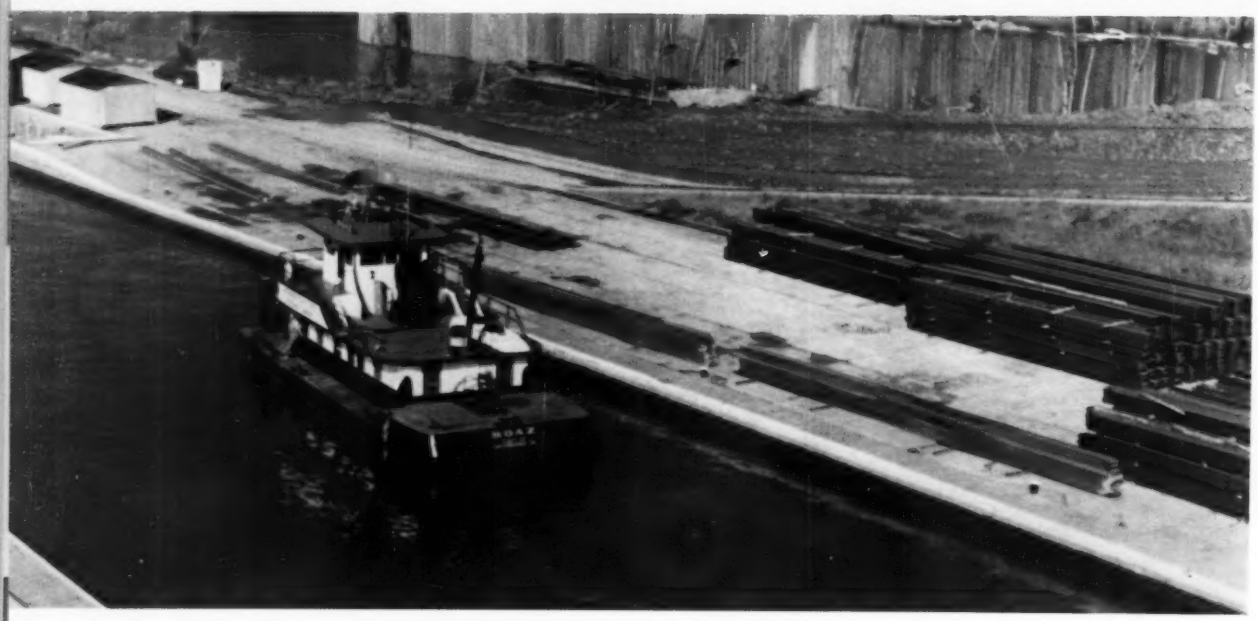
United States Steel

Additional information on next page . . .



Building a cell at Louisville using a template to assure correct diameter.

USS Steel Sheet Piling stacked and ready for use after delivery by barge to Louisville.



Quick deliveries on USS Steel Piling

U.S. Steel's large production facilities and close attention to customer's needs have made possible "on-time" deliveries even in remote sections of the country. When you want any type of piling in a hurry—Steel Sheet Piling or Steel H-Piles—call the United States Steel office near you. For technical information, write United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

USS is a registered trademark

United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Export Company

United States Steel

Civil Engineers research performance of new stressed-skin aluminum bridge structure. Data will provide other CEs with design and specification criteria... first step to sales in construction market.

Controls 30 billion in annual expenditures

Annual construction from 1957 to 1960 averaged 52 billion dollars*. Of this, *engineered* construction, that controlled by the Civil Engineer, amounted to 29.98 billion. This figure *excludes* housing projects, motels and other large residential construction work, which is also normally Civil Engineer controlled. Furthermore the figure does not reflect the extensive influence of the Civil Engineer over residential building codes and practices.

**Summary total from published U.S. Bureau of Census figures*

The CIVIL ENGINEER is DECISIVE

in the purchase of the materials, services, installed equipment, and construction machines used in engineered construction

From conception to dedication **of every engineered construction job, the decision of the Civil Engineer is all pervading and *final*.**

This is not simply a matter of general trade practice. Nor is it merely a convenience. It's a *legal* reality... that holds in varying degree in every state of the Union and in most other countries... that applies not only in public works but in private construction as well.

Often overlooked

The *legal* responsibility of the Civil Engineer for *purchase decisions* is frequently overlooked. One reason for this is the time-honored phrase "or equal" which seems to leave brand decisions up to the contractor. Practically, this is rarely so. Instead the phrase has been used to restrict to one or a very few the number of suppliers capable of meeting the specification. As a matter of fact, the phrase "or equal" has been proved *too* broad... and most of today's specifications read, "or *approved* equal."

Approved? By whom? What criteria?

To suppliers of materials, services, installed equipment, and construction machines used in engineered construction those are pertinent questions. And the answers are not left to chance. In all governmental agencies from Town Councils to Federal Governments standards for both public and private construction are established by legislative action or administrative edict. These standards range all the way from engineering design details to the type of equipment to perform the work.

Legislative action and administrative edict alike are recommended, promulgated, administered... and compliance therewith on specific jobs is supervised ... by the Civil Engineer.

In consulting and contracting firms and a large number of architectural firms a Civil Engineer is the responsible decision-maker who sees to it the item meets required standards and who devises new designs and construction methods ... often based on new materials and equipment. Upon his decisions commercial success of the firms stands or falls.

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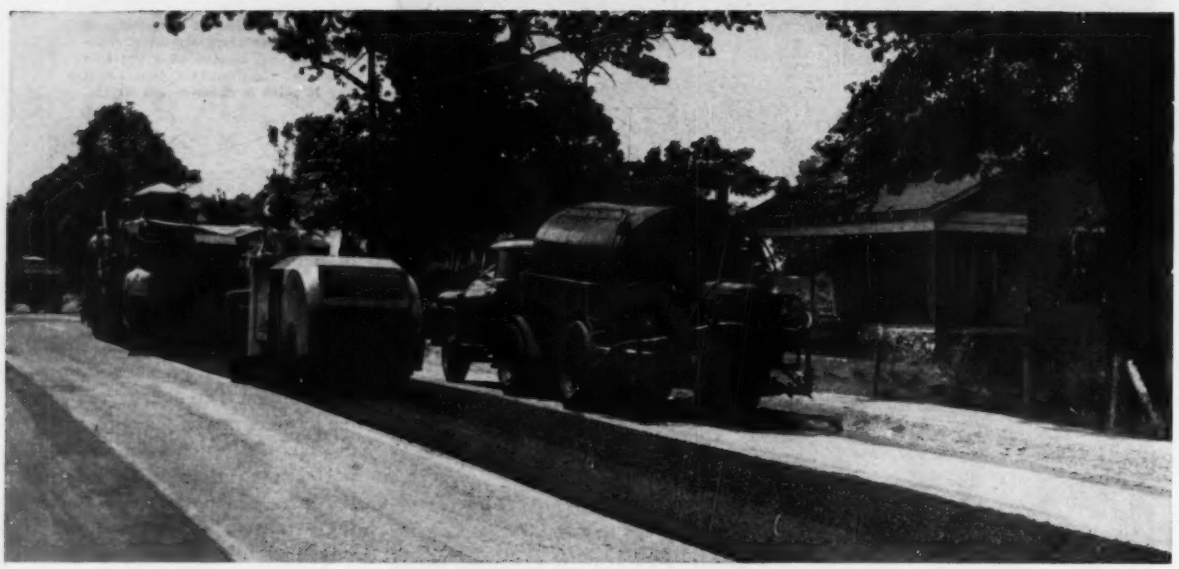

Mixing and placing a Cationic Bitumuls "mat" with a Moto-Paver. Note how closely the roller follows the paver.

This is a completed Cationic Bitumuls Drag Seal Job.

North Carolina forces apply cover aggregate to a Cationic Bitumuls Split Seal on 8.1 miles of State Highway.

CATIONIC BITUMULS NOW USED BY 21 STATE HIGHWAY DEPARTMENTS

Here's why:

1. **Fast Initial Set even in adverse weather.**
2. **Better Adhesion even with "hard-to-coat" stone.**
3. **"Rain-Proof" Coating of Aggregate (resists wash-off in sudden showers.)**

Since 1958, when we first introduced Cationic Bitumuls, it has gained steadily in acceptance by State Highway Engineering Departments all across the nation. Now, in twenty-one of our fifty states this material is in actual use. It is being tested and evaluated by many more.

Here's how one State took to Cationics

In 1958, The State Highway Commission of North Carolina took delivery of 100,000 gallons of Cationic Bitumuls so that one of their fourteen Divisions could do experimental work. When the results were evaluated here's what they found:

1. Early rains didn't damage the work.
2. The roads could be opened to traffic sooner.
3. The surfaces held more cover stone.

Based on these performance reports, the Commission made Cationic material available to all fourteen Divisions. In 1959, they used a total of 4,000,000 gallons. Last year (1960) 8,500,000 gallons!

How Cationic Bitumuls is used in North Carolina

North Carolina uses Cationic Bitumuls for two basic types of work: Split Seal, Drag Seal (Double Surface Treatments), Single Seal, Triple Surface Treatments; and Moto-Paver Mixes. Aggregates used vary from one area to another but the principal ones are gravel, granite, slate and limestone. Cationic Bitumuls performs uniformly well with all of these.

Cities, too, adopt Cationics

Many cities in North Carolina have switched to Cationic Bitumuls for much of their street and road work, profiting by the experience of the State Commission.

This same process is going on all across the country as more and more engineers become familiar with the high-level performance of Cationic Bitumuls.

If you have not had an opportunity to check a Cationic Bitumuls job in person, call our nearest office. A Bitumuls Engineer will arrange for you to visit a job near you.

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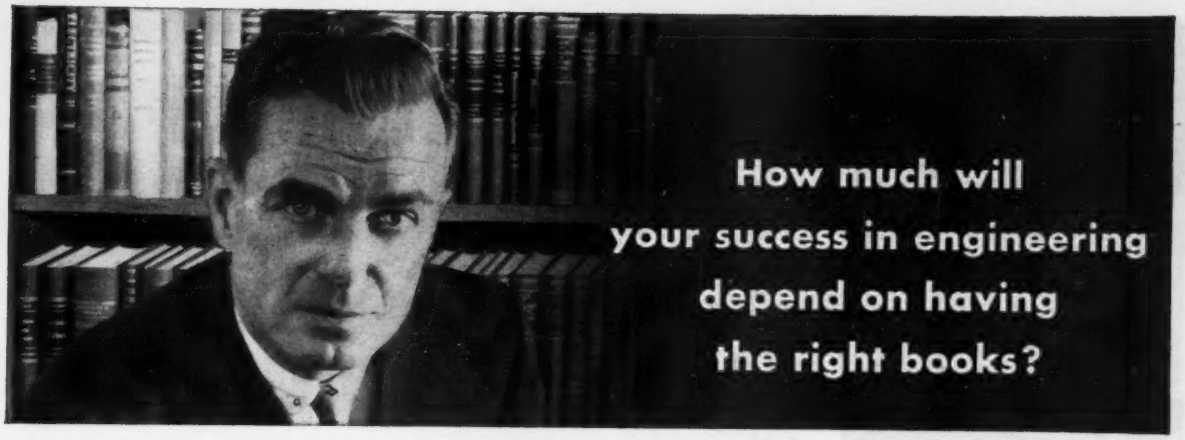

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Publisher's Price, $8.50
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Design and Construction of Asphalt Pavements by J. R. Martin and H. A. Wallace. Modern methods and technology.
Publisher's Price, $11.50
Club Price, $9.80

Handook of Hydraulics by H. W. King and E. F. Brater. 4th Ed. Basic formulas and tables with practical applications.
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Estimating Construction Costs by R. L. Peurifoy. 2nd Ed. Techniques and data to help you make accurate estimates.
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By H. Kent Preston

This book furnishes the busy structural engineer with easy-to-follow information on the design of safe, economical members and structures of prestressed concrete. Here you will find basic principles, design procedures, and numerical examples presented in terms of simple arithmetic and standard stress and moment formulas that are familiar to you.

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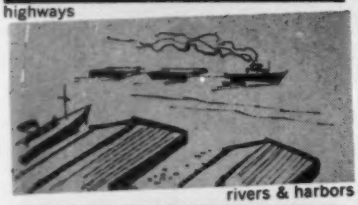
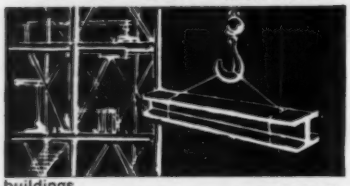
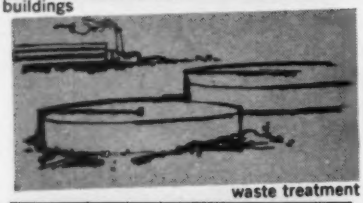
highways



rivers & harbors



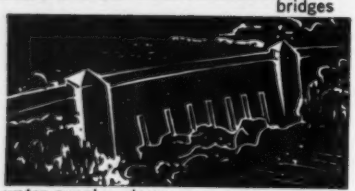
buildings



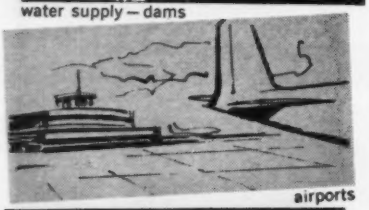
waste treatment

pipelines

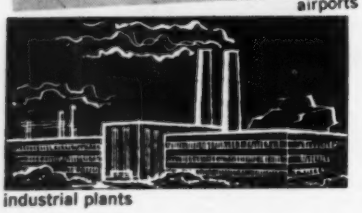
bridges



water supply – dams



airports



industrial plants

WHY ADVERTISING IN CIVIL ENGINEERING STIMULATES SALES IN CONSTRUCTION MARKETS

In the construction industry, four major groups account for nearly all product buying and specifying:

CONSULTANTS ■ CONTRACTORS ■ PUBLIC WORKS ■ OWNERS

Civil engineers occupy key positions in each group. Not only are they responsible for design, construction, operation and maintenance "in the field"... civil engineers are also a primary influence "behind the desk," in charge of management.

As a result of this wide responsibility, civil engineers largely control the specification and purchase of construction equipment, materials and services.

The only magazine edited exclusively to serve the technical, business and professional needs of this select audience is CIVIL ENGINEERING ... official publication of the American Society of Civil Engineers.

Year after year, its circulation has increased with construction activity and the growth of the civil engineering profession. Editorially CIVIL ENGINEERING serves all areas of construction and all civil engineering interests – making it truly The Magazine of Engineered Construction.

Basic data on the civil engineer's role in different construction industry groups is being furnished by A.S.C.E. Mail Forum surveys. For example, the most recent study (of consulting engineers) revealed these facts:

■ CIVIL ENGINEERING's consultant readers own or work for firms that concentrate almost entirely on *engineered construction* projects...with their work divided among the various types of construction as follows:

Airports	3.8%	**Military sites**	3.9%
Bridges	7.6	**Pipe lines**	4.6
Buildings, commercial & residential	17.9	**Rivers & harbors**	1.6
Dams	2.7	**Waste treatment**	10.9
Highways & streets	14.6	**Water supply**	10.1
Industrial plants	9.1	**Miscellaneous**	13.2

■ the average annual cost of all the equipment and materials specified by each of the 290 firms reported is well over $6 million.

■ 90% of the readers influence the purchase and the specification of construction materials, installed equipment and office equipment.

■ their titles and functions are proof of a high degree of authority and a wide area of buying influence within their firms.

In CIVIL ENGINEERING, *advertisers reach top quality consultants concerned only with construction. This is the core of your consulting engineer market ... the men who specify your products!*

And remember...whether your product is specified and purchased through consultants, contractors, architects, owners, public works officials (or any combination of these groups) you get the *most effective, most economical* coverage of civil engineers by advertising in CIVIL ENGINEERING Magazine.

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THE MAGAZINE OF ENGINEERED CONSTRUCTION

The American Society of Civil Engineers ■ 345 E. 47th St., New York, N. Y.

ALPHA
BETTER CONSTRUCTION THROUGH BETTER USE OF CEMENTS
news and notes from the field

THE HIGH COST OF MIXING WATER

Careful job-site control of mixing water is essential for getting the best results in all types of concrete construction. Too much mixing water is a danger recognized by most construction men, and unfortunately the real damage resulting from excess water often shows up too late to be remedied without extensive costs.

Examples of Delayed Damage From Too Much Mixing Water

1. Cracks in foundations—Foundation walls and floors crack excessively from high shrinkage and low tensile strength caused by excessive mixing water.

2. Freeze-thaw damage in pavements—Air is entrained in concrete to protect it from freezing and thawing damage. When the slump is greater than 5 inches, there is danger of the air content decreasing which reduces this important protection.

3. Sand streaks in foundations—excess water bleeds up the sides of forms, washing out the cement paste, and leaving a streaked, raw, unattractive wall surface.

4. Dusting floors—as concrete bleeds, water comes to the surface. If there is excessive bleeding, the water brings aggregate fines to the surface which often cause dusting and crazing.

5. Leaky walls and wet floors—Both can result from excessive voids in concrete caused by too much water.

The Water/Cash Ratio

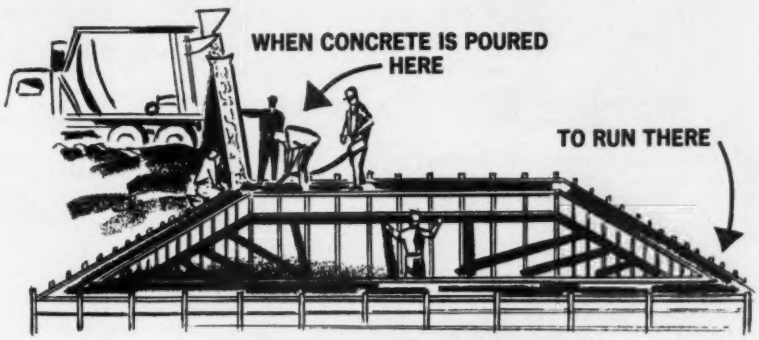
Much has been said and written on the subject of controlling the amount of mixing water, here it is expressed in terms everyone understands: money. To change a typical mix from a 2-inch slump to a 9-inch slump by adding water costs as much as $7.50 per 5-yard load if the strength is maintained. Here's why:

1-In. Gravel Mix, W/C = 6 Gal./Bg. (4000 psi)

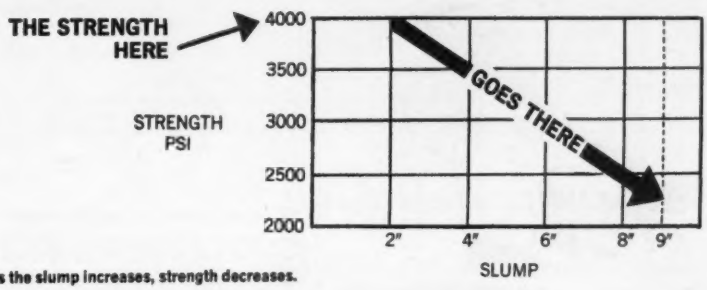
Total water used for 2-in. slump: 30 gal.
Total water used for 9-in. slump: 39 gal.
39 gal. − 30 gal. = 9 gal. excess water added

Required Cement for 6 Gal. W/C Ratio

2-in. slump, 30 ÷ 6 = 5 bags of cement needed
9-in. slump, 39 ÷ 6 = 6½ bags of cement needed



Do not add extra water to flow the concrete from one point to another. Wheel, shovel or chute it into place.



As the slump increases, strength decreases.

6½ bags − 5 bags = 1½ bags additional cement needed to maintain the 4000 psi strength

Extra Cost of 9-In. Slump Per Yd., 4000 psi Concrete

Extra cement costs
Approx. $1.50 per yard
In other words, the extra water costs
$7.50 per 5-yard load
or .....$ .17 per gallon
(figures are approximated)

The cost of mixing water should never be underestimated. Repairs to the structure and damage to the contractor's reputation can be far-reaching and costly . . . it's at this point where the water/cash ratio comes into being—is most easily recognized.

Concrete Has a Bright Future

Concrete is one of the most flexible and widely used of all construction materials. Based on recent advances and the growing trend in design and construction, concrete will continue to grow in favor among engineers, architects and customers. This is why Alpha is promoting these helpful tips on concreting as a continuing program to help improve concreting practices.

Reprints of this information are available free of charge. Contact your local Alpha Representative or write to Alpha's home office.

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Alpha Building, Easton, Pa.

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Uses UNI-FORM Panels. Says they're the fastest, cheapest method of forming concrete he's ever used.

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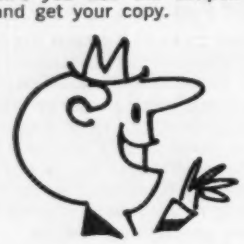

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CATALOG DIGESTS

20 CONCRETE CONSTRUCTION

Concrete Reinforcing Steel Institute—"The Economic Advantages of Reinforced Concrete Building Construction" is a 14-page booklet outlining the different advantages of using reinforced concrete in the construction field. Illustrations accompany the explanation.

21 CONCRETE CONSTRUCTION

The Master Builders Co.—Concreting problems encountered and solved in the construction of 16 stadium and auditorium projects in this country and abroad, are explained in this 20-page Master Builders Co. publication. The role played by "Pozzolith" in acquiring the desired handling properties of concrete during placement and to meet exacting requirements for hardened concrete is also stressed.

22 AIR METER FOR LIGHT WEIGHT AGGREGATE

Charles R. Watts Co.—Full information is available on the Roll-A-Meter, a device for testing both standard aggregate concrete and light weight concrete made of cinders, manufactured aggregate, pumis, etc., and is covered by the ASTM Designation C173-55T.

Turn to page 130 and order your literature.

23 PRESTRESSED CONCRETE—APPLICATIONS AND ADVANTAGES

Prestressed Concrete Institute—A 20-page booklet describes prestressed concrete, telling how it is made, and outlining applications and advantages. Also included are 21 different types of structures in which prestressed concrete is frequently used, along with the primary reasons for its selection in each case.

24 PRECAST CONCRETE FLOOR AND ROOF SYSTEM

Spancrete Machinery Corp.—Spancrete is a precast pretensioned hollow core, machine extruded flat slab and is used as fire safe structural floors and roofs in all types of building construction. It is fully described from production through installation specifications, in a bulletin, now available.

25 CONCRETING—COLD WEATHER

Sika Chemical Corporation—Complete information on accelerating setting of concrete during cold weather is available. Booklet includes test data, specification and technical information on Sikacrete accelerating densifier.

26 CONCRETE ADMIXTURES

Master Builders Company—A guide for specification writers and contractors on concrete admixtures, iron-armoured floor products, grouting and waterproofing materials and other related products for improving concrete and mortar is now available. It contains 10 pages of specifications for concrete, concrete floors, colored concrete floors, equipment grouting and masonry mortar, based on current ASTM and ACI standards.

Please note our deadlines. Requests cannot be processed after these dates.

Concrete Forms

27 FIBRE FORMS

Sonoco Products Company—Sonotube fibre forms for round columns of concrete are illustrated and listed in this brochure. They are designed specifically as a form for round concrete columns and are made from many layers of tough, high quality fibre, spirally wound and laminated together with a special adhesive.

28 CONSTRUCTION SPECIALTIES

Universal Form Clamp Company—Forms, form ties, accessories, construction specialties and highway products are well illustrated and described in this new 56 page catalog.

(CD starts on page 130)

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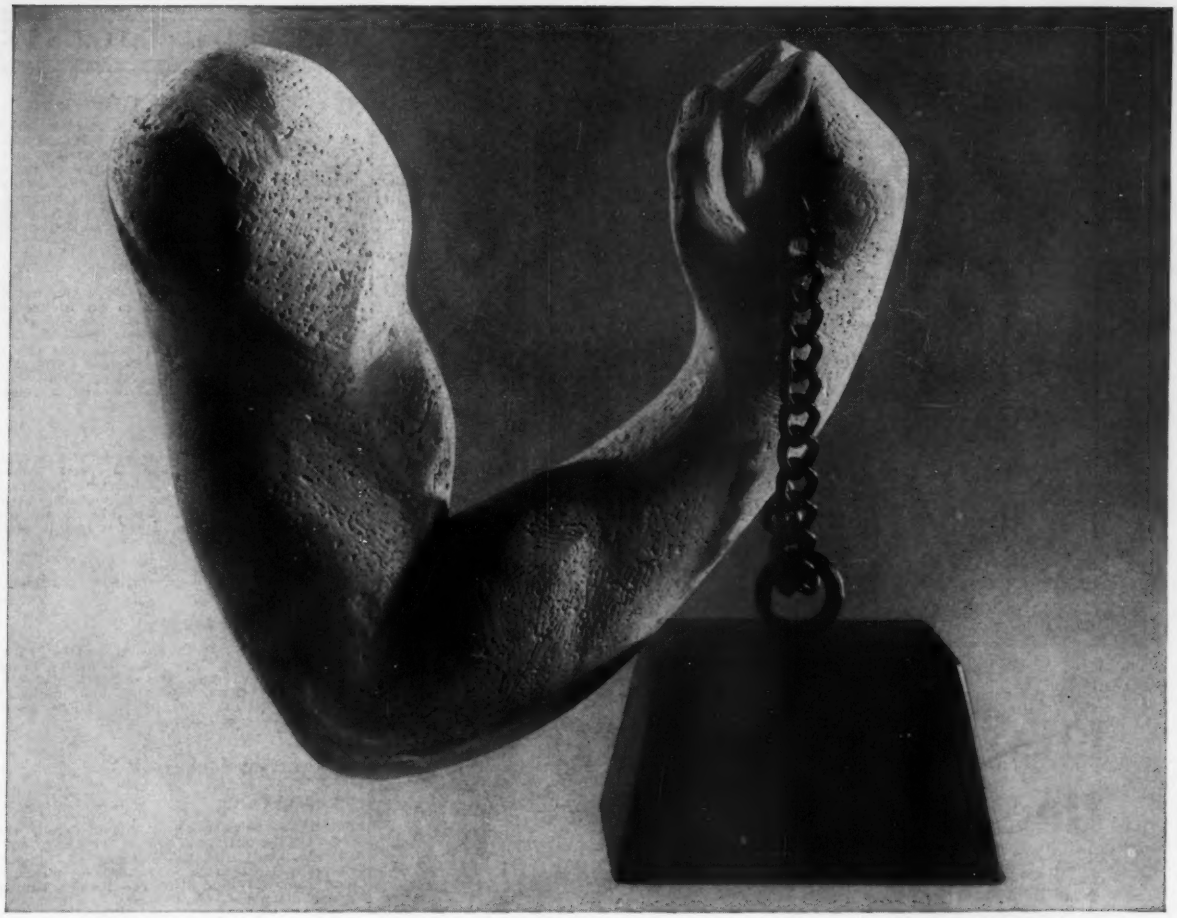

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... the liquid admixture that gives you 5 key controls of concrete

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Less than three ounces of Placewel per sack of cement will also—

• Increase durability 350% • Increase workability
• Improve dimensional stability • Reduce permeability

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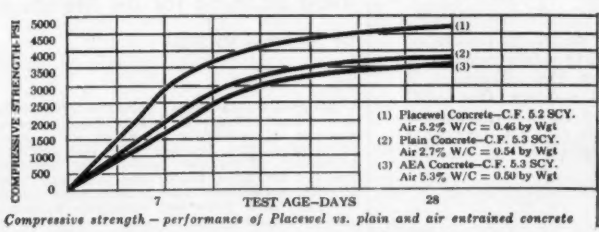
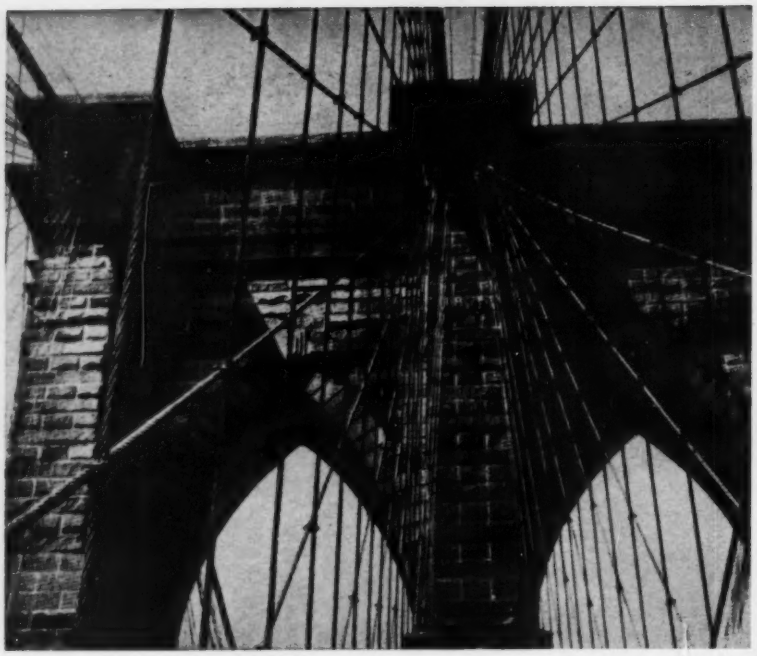
Celite Division



Compressive strength — performance of Placewel vs. plain and air entrained concrete



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CATALOG DIGESTS

29 CONCRETE FORMING SYSTEM

Economy Forms Corporation—A 20-page catalog showing a complete forming system available to contractors on a purchase basis is now being offered. The easy adaptability of these forms to all types of form work, engineering layout service on each new project, together with a complete steel form, makes the form an attractive investment for the large and small builder.

30 CONCRETE FORM DESIGN

Richmond Screw Anchor Co., Inc.—This bulletin, No. 12, contains sections on Richmond Form-Ty Engineering; Charts for Concrete Pressure, Sheething Deflection, Plywood Deflection, Stud Loads, Wale Loads, Joist Loads and Post Loads; Form Design Formulae; Strength Data for Richmond Form Tying, Anchorage and Hanging Devices and Spacing Charts.

31 FORMING BRACKETS

Mas Con Supply Company—offers a leaflet describing the Jahn Forming Brackets. Information is given concerning brackets for horizontal single walers, vertical strongbacks, high wall construction and panels that do not require walers. The ultimate load is 4500 lb with nails and tye fishing unnecessary.

Please give your complete address.

32 INFLATABLE FORMS

Elgood Hydraulics Corp.—Information and specifications on reusable inflatable void forms for prestressed and precast products, drains and sewers, telephone and electrical ducts and heating and air conditioning ducts is now available in Catalog No. 602.

Construction Equipment

33 EXCAVATOR

The Eimco Corporation—Complete details are given on the 631 Excavator in bulletin L-1057. Specifications are also included as to discharge height, machine headroom, standard bucket capacity and discharge distance behind rear of machine.

34 TRACK-TYPE TRACTOR

Caterpillar Tractor Co.—A detailed description of the Caterpillar D9 series G Tractor has just been released. This 20-page booklet tells the details of improvements and new features that have been incorporated into this largest of single engine track-type tractors.

35 COMPACTION EQUIPMENT

The Galion Iron Works & Mfg. Co.—A 16-page "basic training" booklet, SR-31, on soils and materials compaction in connection with construction of roads, streets, air strips, earthworks, dams, etc., is now available.

36 ROCKER SHOVEL LOADER

The Eimco Corporation—Increased bucket cleanup width and greater digging force, provision for digging below depth of rails for ties and improved bucket discharge and arm return are just a few of the details discussed in this bulletin describing the shovel loader.

37 PNEUMATIC TIRE COMPACTION

The Galion Iron Works & Mfg. Co.—Complete specifications and applications of 9-wheel pneumatic tire rollers.

There are 225 Digest items on pages numbered 130 to 160. Read all items for the literature of interest to you.

38 CRAWLERS

International Harvester Company—The full-line folder (CR-650-K) briefly details major features of crawlers in six power sizes, three payscraper units, two paywagon rigs and two payhauler off-highway trucks. Also depicted are the five drott four-in-one machines, four superior sidebooms, two International wheel scrapers, plus cable and hydraulic bulldozer and bullgrader blades.

Helicopter service courtesy Coast Rotors.

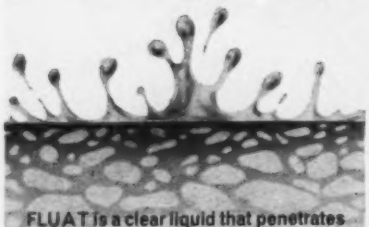
"Electrotape Leapfrog" – world's fastest surveying

"Electrotape Leapfrog" slashes days, weeks, and even months from the time once required to make precise distance measurements. Required to play: a helicopter and a pair of Cubic DM-20 Electrotapes. Order of play: 1. Helicopter flies Electrotape #2 from start point to first tie-point, up to 30 miles away. 2. While Electrotapes measure distance to first tie-point, helicopter flies back to start point. 3. Helicopter flies Electrotape #1 to second tie-point, leapfrogging first tie-point. 4. While Electrotapes measure distance between first and second tie-points, helicopter flies back to pick up Electrotape #2. And so on. Leapfrogging eliminates packing-in through difficult terrain, saves clearing underbrush. Priced at $6000 apiece, Electrotapes quickly pay for themselves by saving operating time and cost. Weighing only 25 pounds, the DM-20 is all-transistorized and provides numerical distance readout. For descriptive literature on Electrotape, write to Department CE-105.

cubic
CORPORATION
INDUSTRIAL DIVISION
SAN DIEGO 11, CALIFORNIA • ROME, ITALY

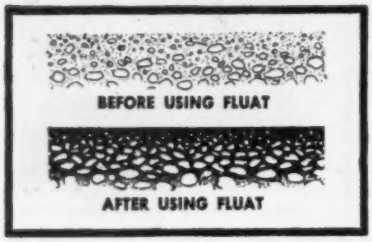
the amazing liquid concrete hardener

FLUAT



FLUAT is a clear liquid that penetrates deeply into the pores of new or old concrete, where it reacts with the free lime and calcium carbonate to turn these relatively soft compounds into extremely hard, insoluble silicates. These silicates completely fill and seal the concrete pores, creating a very dense and hard surface which actually increase the overall strength of a concrete floor!

FLUAT-treated concrete floors have substantially increased resistance to wear, acids, alkalis and oils. Gritty dust from breakdown of concrete surface is eliminated.



FLUAT is easily applied to any clean, dry concrete surface with an ordinary brush. It remains in complete solution and requires no preparation before use.

FLUAT is available from Tretol Distributors in all parts of the U.S. Write or call for the name of your nearest Distributor and the complete Tretol Catalog of products for Concrete construction.

TRETOL INC.

Quality Products for Concrete and Masonry

6051 W. 65th St., Chicago 38, Illinois
Subsidiary of Servicised Products Corp.

CATALOG DIGESTS

39 ROLLER RENTAL

The Galion Iron Works & Mfg. Co.—This is a pocket-size reference guide for those who are not currently familiar with potential economies of renting tandem, three-wheel or pneumatic tire rollers.

40 TUNNEL HAULAGE EQUIPMENT

Mayo Tunnel and Mine Equipment—Tunnel haulage equipment is illustrated and described in a 4-page bulletin No. 18-c. Featured are diesel and battery locomotives and different types of tunnel cars. Also shown are drill jumbos, automatic couplers, car passers, grouters and pea shooters.

41 MOTOR GRADERS

The Galion Iron Works & Mfg. Co.—This pocket-size booklet on a complete line of eight motor graders, includes attachments and condensed specifications.

42 TREE PLOW

The Eimco Corporation—This tool removes all kinds of trees without blasting or digging. Its horizontal-vertical blade severs all lateral and vertical roots in its path. Further details and specifications are included in the bulletin now available.

43 ROLLERS

The Galion Iron Works & Mfg. Co.—This handy specification guide on a complete line of 18 rollers and attachments, includes 3-wheel tandem and pneumatic tire rollers.

Please note our deadlines. Requests cannot be processed after these dates.

For Efficiency and Economy

LENKER DIRECT READING LEVEL ROD

Every Rod Reading an Elevation

No Computations

Graduations Furnished as Follows:
Tenths and Hundreds
Feet and Inches
For Inverted Image Levels
Metric Systems

Write for Circular

LENKER MFG. CO.
599 CHESTNUT STREET
SUNBURY, PA.

Depth Recorders

44 SURVEY DEPTH RECORDER

Edo Corp.—This literature describes and illustrates Model 255CM Survey Depth Recorder, the sonar equipment for charting water depths from 1½ ft to 230 fathoms. Design features assure accuracy and definition of recording.

45 SURVEY DEPTH RECORDER

Edo Corp.—Literature describes and illustrates new Model 555 Survey Depth Recorder, an improved sonar equipment for charting water depths from 1½ feet to 230 fathoms. New design features assure exceptional accuracy and definition of recordings. The equipment is lightweight, for permanent or temporary installment aboard vessels of every size.

Drafting & Reproducing

46 SPEED DRAFTING

J. S. Staedtler, Inc.—A comprehensive 24-page catalog presents a wide variety of items designed to make it easier for engineers, architects and draftsmen to execute drawings with good reproducing qualities.

47 TECHNICAL PAPERS

Keuffel & Esser Co.—"Graph Sheets, Cross Sections & Profile Papers, Cloths, and Films," a newly revised 60-page catalog, consists of two sections: an introductory guide to the selection of grid patterns best suited to individual requirements, and pages selected from the complete K&E Catalog. The reprint pages also describe the various material available: drawing paper, tracing paper, Albanene, tracing cloth, and Herculene and Stabilene films. Applications, specifications and limitations of these various materials are also given.

48 DRAWING LEADS

Koh-I-Noor, Inc.—announces a leaflet on their No. 2200-I Ejectomatic Drawing Leads, No. 2200-D Duette Drawing Leads and No. 2200-M Koh-I-Lar Leads for use on polyester base drafting film. Also described is a complete line of drafting-lead holders and lead pointers.

49 DRAFTING TAPES

Chart-Pak, Inc.—presents a 28-page catalog, showing a complete line of pressure-sensitive tapes for use in drafting and charting. These tapes shown in the catalog are able to be reproduced through the photographic or diazo process. Also included is a full price list on standard tapes, plus facts about obtaining information on special printed pressure-sensitive materials.

50 TRI-ACETATE SHEETS

Stanpat Company—Circular describing their printed adhesive-backed acetate sheets for speeding up drafting is available. These sheets are attached to original drawings and save draftsmen from redrawing standard details and repetitive notes. Resulting prints are clear and sharp and save tremendous amounts of time.

RETURN THE COUPON TODAY FOR IMMEDIATE RESULTS!

Drilling

51 BORINGS

Raymond International Inc.—A booklet "Subsoil Investigations for Foundations" Catalog B-7 explains the reason for subsoil investigations, what Raymond borings are and how they are made, and the results obtained. Illustrated are methods for making borings and taking samples, and various types of rigs in operation.

52 DRILLING EQUIPMENT

Acker Drill Co., Inc.—is offering bulletins 10, 11, 12 and 13 containing information on bits, drill supplies, soil sampling equipment and auger tools. All contain complete specifications and ordering information.

CATALOG DIGESTS

53 DIAMOND CORE DRILL

Sprague & Henwood, Inc.—A masonry diamond core drill machine is described in a 4-page leaflet. The MDS 400, designed for holes from 1 to 6½ in. is equipped with a two-speed electric motor with built-in waterswivel. The unit can be supplied with a vacuum base which features a patented double-gasket sealing principle.

54 CORE DRILLING—BASIC PROCEDURES

Acker Drill Co., Inc.—Core drilling is a process that recovers true, solid cores in the exact same relationship and condition that they occur underground. This 35-page booklet presents the fundamental procedures of core drilling.

55 DIAMOND MASONRY BITS

Sprague & Henwood, Inc.—A 4-page leaflet describing a complete line of diamond masonry bits and accessories, including waterswivels, expansion adapters, etc. is now available.

Flow Measuring Devices

56 PNEUMATIC TOTALIZER

B-I-F Industries—This device multiplies flow rate by time to give total flow. It receives a linear or square root pneumatic signal between 3 and 15 psi and converts this air pressure into diect readout of total flow in volumetric units on a cyclometer-type totalizer. Being self-contained it requires only an input air signal and electrical power connections. More information is available upon request.

57 WATER MEASUREMENT

Thompson Pipe & Steel Co.—Parshall Measuring Flumes, are available in sizes for 0.1 to 1340.0 cu ft per second. Catalog B-31-C contains free-flow discharge tables, sizes, capacities and weights.

There are 225 Digest items on pages numbered 130 to 160. Read all items for the literature of interest to you.

58 REGISTERING SYSTEMS

Leupold and Stevens Instruments, Inc.—Bulletin P15, describes and illustrates Position Motor Type Remote Registering Systems used for remote indicating, recording or control of any moving element, such as liquid levels in rivers, reservoirs or tanks, the head or flow through a weir or Parshall flume or the position of lock gates, valves or bridge draw spans.

59 WATER AND SEWAGE TUBES

Simplex Valve & Meter Company—A description of the CT, CTB and CTJ Venturi tubes, for water and sewage or sludge is given in bulletin 104. Tabular data for sizes 3 in. up to and including 16 in. together with capacities for 64.4 and 114.39 in water differentials are also included.

60 FLUID METERING

Wallace & Tiernan Inc.—Catalog 520.100 describes Glass-tube Varea-meters (rotameters) for fluid metering. Capacities: 0.25 to 310 gpm water, 1.1 to 1300 scfm air. Varea-meters are of unitized construction, and available in various materials to handle most liquids and gases.

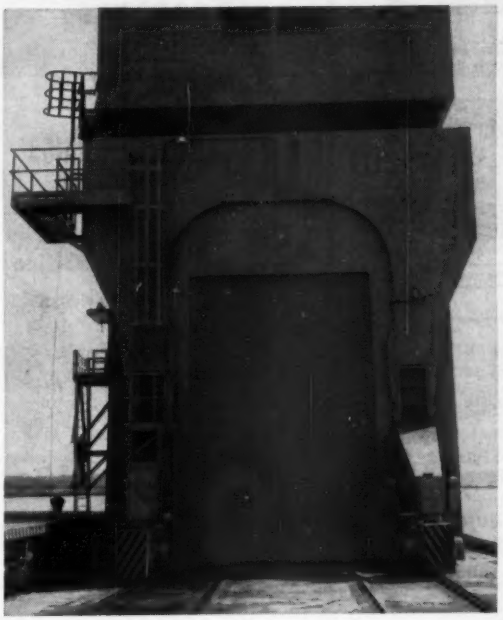
61 CHART RECORDERS

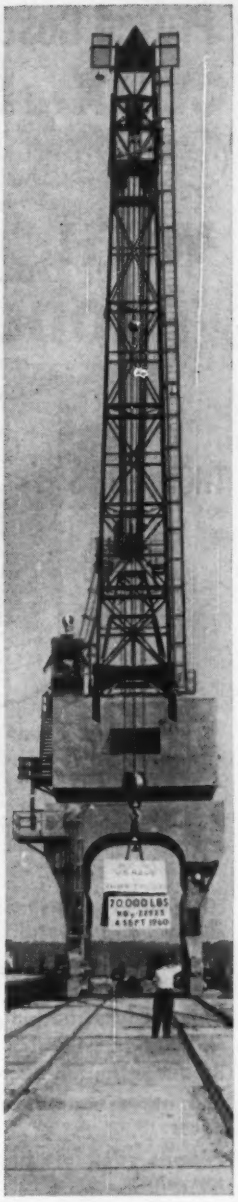
Leupold & Stevens Instruments, Inc.—Type B series recorders are described in Bulletin 25. These circular chart recorders are particularly adapted to waterworks, sewage and industrial uses. Although generally used to record, indicate and totalize the volume of flow through measuring weirs and flumes, models are available for recording head or height only.

62 ELECTRIC RECEIVER

Simplex Valve & Meter Company—Bulletin 728 describes the type "L" electric receiver of the indicating recording and totalizing type. The receiver includes many innovations as well as the completely new time impulse electric receiving element. The bulletin lists special features and advantages of this type of meter.

Giant gantry crane equipped with KINNEAR METAL ROLLING DOORS





Huge Motor Operated Kinnear Doors protect crane's interior from elements

The same space-saving efficiency and ruggedness Kinnear Rolling Doors bring to standard industrial and commercial doorways of every type proves even more important in special applications like this!

These official Navy photographs show a big, high-towered gantry crane* in use at the Polaris Missile Assembly Facility, U. S. Naval Weapons Annex, Charleston, S. Carolina. The large Kinnear Rolling Doors at "fore and aft" of this crane, when closed, fully protect the interior, permitting men to work inside regardless of weather conditions. And open or closed, the doors require no usable "premium" space.

Just one of the many, even more unusual, situations where the proven advantages of Kinnear Rolling Doors can be profitably applied. *We invite you to write for recommendations on your specific requirements.*

**Kinnear recently installed another similar type of installation of doors, 65' wide x 36' high—reputed to be the world's largest rolling doors.*

KINNEAR ROLLING DOORS
Saving Ways in Doorways

The KINNEAR Mfg. Co.
FACTORIES:
1080-90 Fields Avenue, Columbus 16, Ohio
1742 Yosemite Ave., San Francisco 24, Calif.
Offices and Representatives in All Principal Cities

Proved Cost Saver
CURE and SEAL CONCRETE WITH 1 PRODUCT

THOMPSON'S WATER SEAL

Eliminates wet sacks, papers, hosing and spraying

Spray deep penetrating, colorless Thompson's Water Seal on fresh concrete to cure and seal in one operation. Save time . . . save labor.

Effectively controls moisture loss for 28 days and beyond.

Assures uniform curing even in hot, dry weather.

Helps reduce checking, cracking, spalling.

Produces harder, dust-free surface.

Eliminates waterproofing concrete floors.

Permits adequate time for smooth troweling.

Send for technical bulletin and Contractors Case History file.

A proved bond breaker for pre-cast, tilt up and lift slab construction. Permits easy, clean separation of slabs, walls, pre-cast members.

Available in 5 and 55 gallon drums from building supply stores, paint and hardware dealers.

Thompson's
MANUFACTURERS OF FINE PROTECTIVE CHEMICALS SINCE 1929
E. A. Thompson Co., Inc., Merchandise Mart, San Francisco 3, California

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Engineers
Fabricators
Erectors

Structural Steel
BRIDGES and BUILDINGS

AISC

General Office and Shops

PHOENIXVILLE, PA.

CATALOG DIGESTS

Gates & Valves

63 BUTTERFLY VALVES

Henry Pratt Company—The Monoflange Mark II is a rubber seat butterfly valve designed to mount between pipe flanges. Listed in this catalog No. 10 are standards which represent those valve-operator combinations stocked for quick delivery and lowest cost.

64 VALVES—"HOWELL-BUNGER"

Allis-Chalmers-Hyd. Division—These valves provide easy, efficient regulation and control of water under free discharge as so illustrated in this 14-page booklet. The valve is installed at the free end of a pipeline or conduit and discharges either into the atmosphere or into the water.

65 VALVES AND HYDRANTS

Ludlow Rensselaer Valve Mfg. Co., Inc.—Catalog 561 is now available giving detailed explanations and specifications on valves and hydrants. Also included is information on floor stands, extension stems, rollers, tracks and scrapers.

66 SLUICE GATE CATALOG

Rodney Hunt Machine Co.—This 212-page catalog presents the full line of sluice gates and auxiliary water and sewerage control equipment. It covers more than 3,000 combinations of types and sizes of sluice gates, as well as hoisting equipment, fabricated gates of metal and wood, valves, regulators, etc.

In filling out the coupon, please print clearly and be sure that you furnish a complete address.

CATALOG DIGESTS

67 VALVES—BUTTERFLY

Allis-Chalmers-Hyd. Division—In this 46-page booklet are the description, specifications and illustrations for uses of this valve. It features minimum pressure drop which saves power, tight closure reducing leakage, uniform control in all positions, the regulation and closure are quick and it is compact and lightweight.

68 GATE HOISTS

D. J. Murray Mfg. Co.—Catalog GH-353 describes gate hoists specifically designed to control water levels on hydro-electric power plant installations. Illustrations show some typical hoists and lists of types of stationary and travelling gate hoists for the power dam gates to which they are applicable.

69 VALVES—"RING-JET"

Allis-Chalmers-Hyd. Div.—For easy regulation and control of water under free discharge the Ring-Jet valve cuts objectionable spray to a minimum, keeps operating mechanism in the dry and reduces space requirements. The bulletin offered, illustrates the simplicity of construction and easy operation of the valve plus the overall dimensions, discharge characteristics, typical settings and specifications.

70 RUBBER SEAT BALL VALVE

Henry Pratt Company—This valve with standard pressure ratings in 150 or 250 psi is discussed in detail in this 6-page folder, catalog BA-9. Applications, construction details and manual operator dimensions are also included.

71 O-RING VALVE

M & H Valve and Fittings Co.—An iron body hub-end, O-ring, valve has been developed for use with concrete pipe without the use of adapters. This permits a savings in installation expense and cost of adapters. Circular No. 26 is available upon request.

DID YOU MAKE YOUR CHECKS PAYABLE TO THE PROPER COMPANIES? ARE THE AMOUNTS CORRECT?

72 ROTOVALVE

Allis-Chalmers-Hyd. Div.—A 64-page booklet features the Rotovalve with its many distinct advantages. It offers flexibility for the jobs, positive closure, greatest initial shut off, and greatest control of closing time. Three-point bearings permit exact alignment of plugs, body and operating mechanism and the "S" mechanism seats contact in the open position allowing if necessary the repacking of the valve under pressure when in service.

73 STEEL VALVES

Stockham Valves & Fittings—These valves, manufactured in carbon and alloy steels, are detailed completely in this booklet now available. Material specifications and working pressure are also included.

74 VALVES

Allis-Chalmers Mfg. Co., Hydraulic Div.—Howell-Bunger valves for power, flood control, irrigation, drainage, turbine bypass, and aeration of water are described in bulletin 02B9206. The valves have a wide range of application where easy, efficient regulation and control of water flow under free discharge is demanded.

Grating

75 GRATINGS

Borden Metal Products Co.—A 16-page catalog shows the three basic types of grating construction; more than 30 dimensional drawings of subtypes; eight safeload tables covering steel and aluminum gratings, roadway grating and sidewalk slabs plus other tables on panel widths, tread widths, floor armor, etc. Also shown are the various safety treads and their nosings. Included are the steps for careful planning and checking of the job.

76 DRAIN GRATES

Irving Subway Grating Co., Inc.—A four-page, two-color folder illustrating the use of open mesh steel flooring as drain grates is available. The folder contains photographic illustrations and shows typical uses of drain grates. There are engineering drawings of the various types and complete technical data to facilitate estimates and specifications.

77 ALUMINUM GRATING

Borden Metal Products Co.—A brochure by way of diagrams and photos illustrates the properties and use of aluminum floor gratings. Also shown are tables of their specifications. A description of safety grating and aluminum safety steps is featured.

78 ALUMINUM GRATING AND TREADS

Irving Subway Grating Co., Inc.—This Aluminum Grating catalog contains illustrations, descriptions, loads and spans table, weights, and other engineering data on aluminum riveted, pressure-locked grating products, for use as flooring, treads, walkways and trench covers. They are light weight, non-rusting, self-draining, self-cleaning, ventilating, fireproof and economical.

PLEASE PRINT NAME CLEARLY

79 STEEL GRATING AND STAIR TREADS

Kerrigan Iron Works Co.—Because of a new arrangement of standard, close spaced and tread data, this bulletin makes it easier for the reader to find specific types of grating. Included in File No. 14-R are complete tables on safe loads and weight.

80 GRATING FLOORING AND TREADS

Irving Subway Grating Co., Inc.—General Grating Catalog F400 contains illustrations, full line of grating products made in steel, aluminum and other metals. Catalog shows riveted, welded and pressure-locked types for use as flooring, treads, walkways, trench covers, and so on. Irving grating is safe, durable, self-draining, ventilating, clean, fireproof and economical.

81 ALUMINUM GRATING DESIGN

Kerrigan Iron Works Co.—A catalog on Weldforged aluminum grating is offered. New forming process prevents cross bars from turning—eliminates the use of rivets, bolts and screws. It contains engineering data including safe load table and also stair tread data.

Metals

82 LONGSPAN JOISTS

Haven-Busch Company—The new "LA" series catalog and tables using A-36 steel on the T-Chord Longspan Joists with spans up to 175 ft clear, is now available.

83 STRUCTURAL COMPONENTS

Commercial Shearing & Stamping—A 12-page booklet, with engineering-detail case-histories, shows the use of steel liner plates, ring walers, ribs & posts, anchor bolts & tie rods, and cold bent roof supports.

84 STEEL CONSTRUCTION

Inland Steel Company—This is a catalog of construction products including piling, Hi-Steel, Tri-Steel, Hi-Man, Hi-Man 440, structural shapes, 4-way Safety Plate, universal mill plates and sub-purlins. Data for high-strength structural steels include tensile requirements, chemical composition, and 180 deg bend test requirements.

Please give your complete address.

85 SPRAYED-ON FIRE PROTECTION

Keasbey & Mattison Co.—A 4-page color folder gives up-to-the-minute information and technical data on Sprayed "Limpet" Asbestos, including results of its most recent fire tests. Its application to metal beams and columns as well as to cellular steel floors is illustrated and fire ratings listed for each type of use. Sprayed "Limpet" Asbestos now offers protection from flames up to five hours depending upon the thickness of the blanket.

86 MARINE CONSTRUCTION PRODUCTS

Commercial Shearing & Stamping Company—This 8-page booklet covers tie rods, anchor bolts, fabricated structures, handrailing, anchor brackets, catwalks, single and double channel wales verbally, photographically and schematically.

Return the coupon today!

87 PRODUCTS AND SERVICES BOOK

Pittsburgh-Des Moines Steel Company—has published a 44-page brochure which describes the overall scope of its activities in the steel construction industry, embracing design, fabrication and erection of a wide range of structures in steel, steel alloys, aluminum-, nickel-, and stainless-clad steels and other materials.

88 NON-CORROSIVE COATING

Rip-Trude Corporation—Top-Galva is a metallic solution which when sprayed, brushed, or dipped on galvanized metal, forms a union with the zinc and deposits on the zinc, a non-corrosive, non-chipping coating. Further information is now available.

Paving

89 SURFACING COMPOUND

American Bitumuls & Asphalt Company—Completely illustrated booklet describes use of factory-made Walk-Top for colorful moisture sealing and smoothing of pavement surfaces on playgrounds, walks, and driveways.

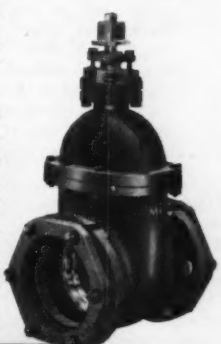
MH Roll-call for water

the Bird Woman's home

When Lewis and Clark first explored western United States, they found an exceptional Indian woman in what is now Missouri. Her name was Sacajawea (said to mean bird woman) and her services as guide and interpreter to the expedition were invaluable. It was a wild and rough journey. There were no cities and no public water distribution system in the Prairie Belt states in those days. But the report of their expedition inspired thousands of eastern people to organize wagon trains and start West from St. Louis, as Lewis and Clark had done, up the Missouri River and her tributaries.

Today this Prairie Belt of 7 west-north-central States produces grain and is sometimes called America's bread basket. The Indians and the buffalo are gone. In their place are modern farms, homes, highways, railways, airports and cities. Of the 40 cities of 25,000 population or more, 29 have adequate water systems, 5 have water works of uncertain efficiency, and 6 have water works which are definitely deficient in overload capacity.

Minnesota
Iowa
Missouri
North Dakota
South Dakota
Nebraska
Kansas



M&H VALVE AND FITTINGS COMPANY
ANNISTON, ALABAMA

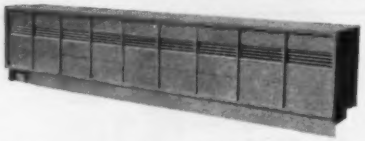
MURCO

GATE HOISTS

For any size power dam . . . . . .

DESIGNED TO MEET YOUR REQUIREMENTS

MURCO Gate Hoists are designed and made for any size power dam . . . capacities from less than 1 ton to over 375 tons . . . from the smallest hand operated to the largest motor operated gate hoist, all made to specifications. . . . . .



For the second largest hydroelectric power plant in the United States at Massena, New York—as part of the St. Lawrence power project—Uhl, Hall & Rich, project engineers, selected MURCO Gate Hoists to control the water level at Long Sault Dam. . . . . .

One of the two 380-ton MURCO Gate Hoists furnished to the Power Authority of the State of New York.

Each hoist operates a gate 46' wide by 67' high at one foot per minute. These gates divert the water from the Niagara River above the Falls into covered conduits five miles long. The two conduits bring the water to the Niagara Generating Plant on the United States side of the Falls.

. . . . . .

Write for complete information . . . Engineering Department recommendations . . . when you are planning power dam projects.

D. J. MURRAY MANUFACTURING CO.

MANUFACTURERS WAUSAU MURCO SINCE 1883 WISCONSIN

CATALOG DIGESTS

90 SLURRY SEAL

American Bitumuls & Asphalt Co.—"Bitumuls Slurry Seal" is an operation which consists of mixing the aggregates with Bitumuls and water to a slurry consistency in a transit mixer, and spreading it over the pavement by a specially constructed squeegee type spreader-box. The action of the squeegee forces the slurry into the fine cracks of a weathered but still sound surface of an old asphalt pavement, thereby reducing expensive maintenance patch construction to a minimum.

91 BITUMULS—CATALOG

American Bitumuls & Asphalt Company—After extensive testing, the company is offering a booklet which covers every phase of application from surface treatments to mixing operations. Of all developments in the paving field, this appears to have most promise because it permits re-activation of old, by-passed aggregate sources and less concern for early rain.

92 BITUMULS EMULSIFIED ASPHALT

American Bitumuls & Asphalt Company—Special advantages of bitumuls emulsified asphalt for surface treatments and penetration pavements are discussed in detail in a 24-page technical catalog, A-1. Tabular data is provided on quantities of materials required per sq yd for various types of surface treatments and for penetration pavements.

93 ASPHALT PAVING

The Asphalt Institute—"Maintenance of Asphalt Pavements" (Information Series No. 117) is a comprehensive booklet which covers patching, surface repair, crack-sealing methods and the rehabilitation of old pavements.

Piles

94 SPLICER

Associated Pipe & Fitting Company—Illustrated in this leaflet are the step-by-step details of assembly of the Steel H-Beam Bearing Pile Splicer. Some advantages include: a sleeve to drive multiple lengths so that the average pile driving equipment can be used, less welding is required thus cutting time and expense and the sleeve will support the beam during the operation thus making available the other equipment.

95 FOUNDATION PILES

The Union Metal Mfg. Co.—Catalog No. 91 on Monotube foundation piles is available. In addition to general descriptive information, the catalog contains engineering data covering physical properties, specification suggestions and test loading; also, contractor data on concrete volumes and weights are included. Advantages listed are: light weight, easy handling, economical field extendability, visual inspection after driving, and high load carrying capacity with extra high economy per ton load supported.

96 FOUNDATION PRODUCTS

Armco Drainage & Metal Products, Inc.—Described in this 16-page catalog, FP-13559 are three basic types of foundation piles—pipe piles, caissons, and Hei-Cor pile shells. Where used, wide variety of structures, selection of end closure are some of the subjects covered. The booklet includes tables, specifications, information on driving equipment, and pictorial case histories.

97 PILES

Raymond International Inc.—Standard and step-tapered piles are described in Catalog S-61 which also includes information on the scope of Raymond's activities covering every recognized type of pile foundation. Domestic operations include harbor and waterfront construction, and cement-mortar lining of pipelines in place. Raymond's services abroad also include all types of general construction.

98 STEEL POINTS

Associated Pipe & Fitting Company, Inc.—The Pruyn Heavy Duty cast steel points which guard against deformation and strengthens the H-Beam Pile is illustrated in this leaflet. The point is made of high carbon steel, tough and strong enough to withstand the abrasive action of all obstructions encountered in the hardest soil.

99 PILE DRIVING

C. L. Guild Construction Co., Inc.—An 8-page brochure entitled "The Caudill Drive-Point Pile" includes an illustrated description of this pile with a patented boot that allows the mandrel to lock the boot to the steel shell. Also included are field load tests and a table giving data on the size and structural strength of the pile.

100 PRESTRESSED CONCRETE PILES

Raymond International Inc.—Catalog CP-3 describes and illustrates Raymond cylinder piles of prestressed concrete. Information is given on the merits of prestressed concrete piles for foundations of bridges, waterfront and off shore structures. Shown are many examples of installations and suggested designs.

Pipe & Pipe Accessories

101 PIPE INFILTRATION

Centriline Corporation—"Sewer Pipe Infiltration" is the technical information catalog on the use of the Centriseal Process. The process is for remotely stopping infiltration in leaking sewer and storm piping by the use of plastic grout coupled with closed circuit television for the location and inspection of leaking joints.

102 FASTITE JOINTS—DOUBLE-SEALING

American Cast Iron Pipe Company—This revised illustrated 12-page brochure describes the advantages of the double-sealing, single gasket Fastite Joint. It contains instructions for assembly, weights and dimensions, and typical installations of American Fastite pipe for water, sewage and other liquid service.

103 PIPELINE DREDGES

Ellicott Machine Corp.—A 16-page bulletin, No. 980, discusses hydraulic pipeline dredges. Portability, size and recent factors in the engineering and design of "Dragon" dredges are explained. Charts give performance figures of the dredges.

104 LIGHTWEIGHT PIPE & FITTINGS

Naylor Pipe Co.—Bulletin No. 59 illustrates and describes spiralweld pipe for construction uses. Push-pull ventilation, high and low pressure air and water lines, dredging pipe, etc. in diameters from 4 to 30 in. It includes standard fittings, welded flanges, one-piece Wedgelock couplings, and connections for pipe line requirements.

105 ASPHALT LINER MANUAL

W. R. Meadows, Inc.—announces the availbility of a "Hydromat" Asphalt Liner Manual. The "Hydromat" Manual fully describes applications and contains installation information, necessary technical engineering data and specification information. This is not a sales catalog, but strictly a Technical Data Manual.

106 PIPE LININGS

Centriline Corporation—"Sewer Pipe Infiltrarings For Pipes" is the name of the catalog describing the process for applying acid resistant epoxy mortar to pipe ranging from 24 to 144 in. The process can be used to line single pipe lengths above ground, new pipe after it has been installed, or recondition damaged steel, cast iron concrete pipe.

PLEASE BE PATIENT
YOUR REQUESTS TAKE TIME

107 PIPE—MOLOX BALL JOINT

American Cast Iron Pipe Company—Molox Ball Joint Pipe for river crossings and other submarine service is the subject of a revised 32-page illustrated catalog. It contains instructions for assembly, weights and dimensions, tables and various installation procedures.

108 JOINT PIPE

U. S. Pipe & Foundry Company—An 8-page booklet is offered on Usiflex boltless flexible joint pipe. The joint is simple, rugged, locked against pull-out and assembled without the use of bolts. Ideally suited for submarine installations.

CATALOG DIGESTS

109 CAST IRON PIPE, HYDRANTS AND VALVES

R. D. Wood Company—A general catalog is available providing full details of weights and dimensions of "sand spun" cast iron pipe and cast iron fittings. This catalog also features fire hydrants, gate valves, and other products manufactured by this company.

Please give your complete address.

110 CONCRETE PIPE

No-Joint Concrete Pipe Company—This company offers a pamphlet describing the tamped and vibrated, arch design, cast-in-place, concrete pipe laying process. Another advantage is that cast-in-place pipe forms a near perfect bond, with the bottom 230° and side walls of the trench giving added strength.

111 CONCRETE PIPE—REINFORCED

American-Marietta Company—A pamphlet containing many photos showing how elliptical Hi-Hed Reinforced Concrete Pipe saves trench width in congested areas and has up to 50% greater strength than its round pipe equivalent. Includes charts on headwall details, physical characteristics and hydraulic properties and discharge graphs. Also folder on elliptical Inner Circles Pipe illustrating quick passage of pipe through pipe underground without disruption of surface traffic.

112 CONCRETE PIPE

American-Marietta Co.—This pamphlet covers elliptical Lo-Hed Reinforced Concrete Pipe for culverts and sewers. Specifications are given for the complete range of sizes from the equivalents of round pipe 18-in. I. D. through 144-in. I. D. Illustrations show results of pressure tests and installations of Lo-Hed pipe being made on various types of jobs.

113 REXON PIPE COATING

Hamilton Kent Mfg. Co.—A 4-page bulletin describes Rexon No. 2 pipe coating for concrete sewer pipe and other masonry structures subjected to extreme corrosion conditions. It is a synthetic hard rubber which vulcanizes to the masonry surface by catalytic action, and leaves no pin-holes. It is resistant to virtually all acids, alkalies, greases and solvents.

114 RUBBER TYLOX GASKETS

Hamilton Kent Mfg. Co.—A 4-page brochure describes and illustrates Tylox "C" and "C-P" rubber gaskets for coupling concrete sewer pipe of all sizes, either straight tongue-and-groove, or single and double offset types. Cross-sectional diagrams illustrate the sealing action of gaskets when compressed in pipe joints.

Return the coupon today!

115 TRANSITE SEWER PIPE

Johns-Manville—An 8-page brochure describes the advantages of Transite Sewer Pipe for non-pressure sewer service. It emphasizes tightness, reduction of infiltration, high flow capacity, speed of installation and prevention of root penetration. Bulletin TR-165A contains tabular data giving sizes and weights of sewer pipes in five available strength classes, 1500, 2400, 3300, 4000 and 5000 psi, as well as tabulated crushing strength data in comparison with other materials (A.S.T.M. 3-edge bearing method).

116 UNDERDRAIN PIPE

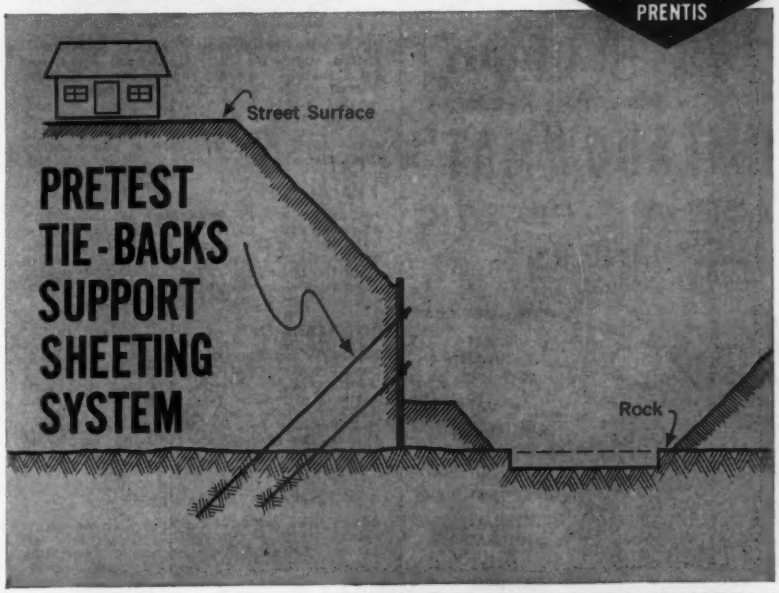
Johns-Manville—This folder describes advantages of Johns-Manville perforated Transite asbestos-cement underdrain pipe for airports, highways and other large areas where drainage is a problem. The pipe is designed for subgrade stabilization of soil by maximum control and removal of subsurface water. The physical and chemical qualities of asbestos and cement include: strength, toughness, light weight and resistance to internal corrosion and most chemical action.

117 TRANSITE PRESSURE PIPE

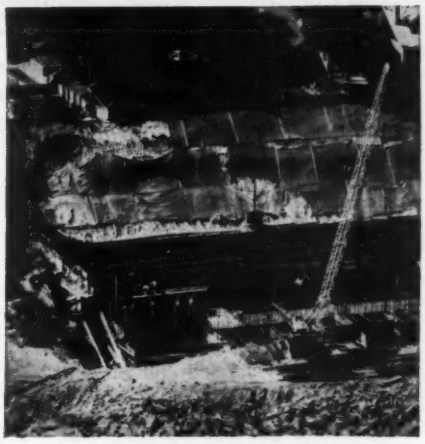
Johns-Manville—An 8-page brochure describes and enumerates the advantages of Transite Pressure Pipe for use in water mains. TR-160A contains tabular data giving the sizes and weights of the pressure pipes in the three available classes, 100, 150, and 200, including the weights of couplings for each. Considerable emphasis is given the Ring-Tite method of assembly.

Owner: City of Milwaukee
General Contractor: Bauer Construction Co., Milwaukee, Wis.
Engineers: Black & Veatch, Kansas City, Mo.

ANOTHER PROBLEM SOLVED BY SPENCER, WHITE & PRENTIS



NOVEL PLAN ELIMINATES NEED OF RAKER BRACING



170' x 65' lot is 80' below street level.

The above-pictured system of horizontal wood sheeting and soldier beams extends 30 ft. to subgrade. It is dependably retaining a heavy earth bank, without the customary support of diagonal braces into the lot.

Instead, an unusual method supports the sheeting from the *exterior* side—by means of Pretest cable tie-backs which are socketed into bedrock, as indicated in sketch.

Developed by Spencer, White & Prentis, the tie-back method (patent app. for) has proved completely successful in one installation after another. Send for literature explaining how this method gives you a free-and-clear work area, permits savings on excavation, form work and other operations.

Spencer, White & Prentis INC.

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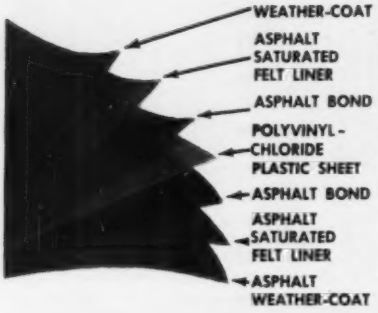
NEW
SEALTIGHT®
"MEADOWMAT"
ASPHALT-PLASTIC LINERS



. . . for the containment of water, chemicals, brines and sewage.

"MEADOWMAT" Asphalt *armor-coated* plastic Liners combine the strength and elasticity of polyvinyl-chloride plastic with the efficiency and durability of asphalt. This new and unique mat-type liner will effectively solve many problems faced in the control of liquids. Specifically developed to meet the present need for a light-weight, low-cost durable and efficient lining material. "MEADOWMAT" Liners provide a strong, durable material with weight and substance that is easy to place without worry of punctures or tears. Easy to join and seal on-the-job... highly resistant to weathering under exposure to the elements and most acids, alkalais, salts and micro-organisms. "MEADOWMAT" Asphalt-Plastic Liners are nominally one-eight inch thick and presently available in sheets 4′ wide, lengths up to 15′ and weigh three-quarter pounds per square foot.

IDEAL FOR LINING . . .

- WATER RESERVOIRS
- CHEMICAL TREATMENT PONDS
- SEWAGE LAGOONS
- GENERAL CONTROL OF LIQUIDS

Write for complete information

W. R. MEADOWS, INC.

20 KIMBALL ST. • ELGIN, ILLINOIS

CATALOG DIGESTS

118 UNDERGROUND IRRIGATION MAINS

Johns-Manville—Transite underground irrigation mains for turf, landscaped areas and farm installations are described in booklets offered by Johns-Manville. Light weight, long lengths and Ring-Tite joints result in economical assembly. Smooth pipe interior insures high water carrying capacity, reduces pumping costs, saves water. The pipe is non-metallic, can't rust and resists corrosion inside and out.

119 CLAY PIPE

National Clay Pipe Manufacturers, Inc.—This 48-page fully illustrated brochure entitled "The Story of Clay Pipe" contains an historical record of clay pipe, its contribution to America from the beginning of the 20th century to the present, and a look into the future of American homes, industries and communities.

120 CLAY PIPE

National Clay Pipe Manufacturers, Inc.—A 6-page brochure, "Lifetime Vitrified Clay Pipe," is of particular interest to professional engineers. It contains lists of ASTM, ASA and AASHO specifications applicable to vitrified clay pipe, and describes new factory-made pipe joints. Clay processing today, and the typical characteristics of vitrified clay pipe also are included.

121 PIPE—STRUCTURAL PLATE

Armco Drainage & Metal Products, Inc.—This catalog, MP-1660 gives technical data on Armco Multi-Plate Pipe, including description of plates, method of assembly, bolts, foundations, headwalls, shop-ellipsed pipe, field strutted pipe, and back filling and tamping. Useful tables and graphs are included, with photos of representative installations.

Please note our deadlines. Requests cannot be processed after these dates.

New book tells
Where . . .
How . . .
to place reinforcing bars

Written for bar setters and inspectors . . . as a manual for apprentice courses . . . and a reference for specification writers, architects, engineers, and detailers.

Contains complete specifications and instructions for placing reinforcing bars, welded wire fabric, and their supports.

Prepared under the direction of the C.R.S.I. Committee on Engineering Practice.

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Chicago 3, Illinois

122 PIPE—WELDED STEEL

Armco Drainage & Metal Products, Inc.—This comprehensive catalog, P. O. 8558, covers applications, advantages, specifications, production limits, tolerances, linings and coatings, fittings, joints, and other essential data for industrial uses. Some of the subjects are factory piping, process piping, water supply and waste disposal lines. Many tables of useful data are included for the designer.

123 PIPE—CORRUGATED METAL

Armco Drainage & Metal Products, Inc.—Described in this catalog, CMS-5859, are the various types of factory-fabricated, riveted or locked-seam corrugated metal pipe and pipe-arches. It describes these types, explains their advantages, assists in making dimensional and material decisions, and recommends general installation procedure. Tables, drawings, and photos of representative installations are included.

124 ASBESTOS-CEMENT PRESSURE PIPE

Keasbey & Mattison Company—"The Heart of A Good Water System" is the title of a four-page folder describing products features and physical details of asbestos-cement pressure pipe for water systems. The folder (AP-27) highlights the installation and maintenance economics and briefly explains the advantages of a patented coupling which provides permanent leak-tight and root-tight seals.

125 GRAVITY SEWER PIPE

Keasbey & Mattison Co.—Asbestos-cement gravity sewer pipe, designed for economical, long life non-pressure sewer systems, is described in a 4-page folder, AP-22. Profusely illustrated, it points up savings in design, installation and operation with asbestos-cement pipe. Complete dimensions, tolerances as well as other specifications needed by the engineer are included.

Pumps

126 SEWAGE PUMP

Yeomans Brothers Company—Smaller sizes of sewage and solids pumps, Series 6000, are cataloged in a 4-page bulletin, No. 6006. Pumps covered range in capacity from 50 to 500 gpm and from 5 to 50 hd-ft. The bulletin contains selection curves of sizes for 1750 and 1150 rpm units; a cutaway view showing details of pump construction; and dimensional drawings of models for flexible shafting, horizontal mounting and the self-supported motor.

127 PUMPS—DIAPHRAGM

Benson Laboratories, Inc.—A data and selection bulletin covering the expanded line of patented hydraulically operated diaphragm pumps is now available. The capacity of the 36 models ranges from 0.003 gal to 300 gal per hour for simplex units and up to 600 gal per hour for duplex units.

128 PUMPS—AXIAL AND MIXED FLOW

C. H. Wheeler Mfg. Co., Economy Pump Div.—A 12-page catalog describes Axial and Mixed Flow Vertical and Horizontal Pumps for applications in flood control, irrigation and drainage projects, large scale primary water supply, industrial and process work, and power plant condenser circulating systems. Catalog includes construction and design details, station arrangement suggestions, and illustrations of typical installations.

129 SUMP PUMP

Motoramic, Inc.—This drainer, with built-in motor protection, is fully described in this folder. Technical data, diagrams and special features are included.

Turn to page 130 and order your literature.

130 DRAINAGE PUMP

Motoramic, Inc.—This submersible drainer, Weda L3Z, weighs less than 100 lb and can be moved while operating. Its pumping capacity, at a 20 ft head, is 315 gal per min. Illustrations and further details are included in this brochure.

CATALOG DIGESTS

131 PUMPS—VERTICAL WET PIT

Yeomans Brothers Company—An 8-page bulletin, No. 8008, presents selected sizes of vertical centrifugal wet pit pumps (screenless). Sizes range from 75 to 1200 gpm at heads of 10 to 75 ft. Dimensions and typical specifications are also included.

Radios

132 CAR TRANSMITTER RADIO

Globe Electronics—The CB-200 Broadcaster Deluxe is completely described in a bulletin now being offered. A five channel selector, a squelch and noise limiter circuit and the tricentric knob and tuning dial are all included as outstanding features.

133 TWO-WAY RADIO

Globe Electronics—A bulletin describing the "Pocketphone" radio is now available. This pocket-size radio has a range from ½ to 1 mile, and requires no license.

Soil Explorations

134 SEISMIC SUBSURFACE EXPLORATION

Geophysical Specialties Company—This brochure explains the GSC Contract Service available to civil, consulting, highway, mining and construction engineers for seismic subsurface exploration to locate: underground water reservoirs; depth of overburden; depth to bedrock and rippability of materials.

135 SOIL COMPACTION

Vibroflotation Foundation Co.—Available is a booklet entitled "Soil Compaction by Vibroflotation" which describes the soil consolidation and engineering services of the Vibroflotation Foundation Co. The booklet illustrates the compaction of 8 to 10-ft cylinders of sandy soil to provide a firm foundation of sand for any type of structure. To make sure of complete coverage in a given area, these cylinders are overlapped according to a predetermined pattern under individual loadings or under entire building areas.

136 NUCLEAR EQUIPMENT FOR SOILS ENGINEERS

Testlab Corp.—A 12-page brochure that describes an improved nuclear system for rapidly and accurately determining soil moisture and density is now available. The brochure also describes balloon density apparatus, sand cones using plastic jugs and low cost drying ovens.

137 SEISMOLOGY

Geophysical Specialties Company—An instruction manual on the MD-1 Engineering Seismograph, 86 pages divided into 12 sections. Topics include: principles of engineering seismology; field procedures; routine seismic analysis; advanced interpretation methods; use of special accessories; step-by-step example of seismic interpretation, and a set of 12 practice problems. $25.00 per copy.

N.B. There is a charge for this book. Make checks payable to Geophysical Specialties Company.

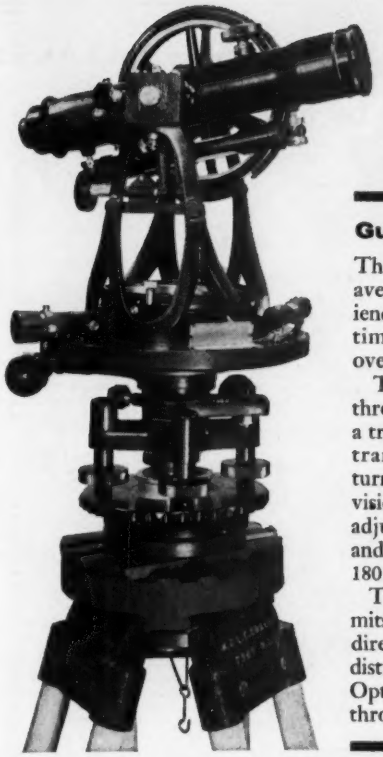
138 SOIL SAMPLING—BASIC PROCEDURES

Acker Drill Co., Inc.—This non-technical, 67-page, booklet is presented as a source of elementary information on generally accepted field procedures of soil sampling. This book deals only with the securing of the sample and not its subsequent laboratory analysis.

Please give your complete address.

139 SEISMIC EXPLORATION

Geophysical Specialties Company—This illustrated 8-page booklet, explains the techniques of seismic exploration using the self-contained, portable MD-1 Engineering Seismograph. It gives a chart developed by leading equipment manufacturer which shows ripper performance as related to seismic wave velocities and shows how seismic analysis protects profits on jobs based on firm bids by indicating depth of overburden, ripability of rock and depth to bedrock.



A Guide to OP and VP

Gurley Optical Plummet

The Optical Plummet Transit opens new avenues in accuracy, speed and convenience...eliminates inconvenience and lost time involved in centering a plummet over a point.

The Optical Plummet is a telescope through the vertical center (spindle) of a transit. It will point vertically when the transit plate is level. The telescope is turned at right angles by a prism, so that vision is actually horizontal. Setting and adjustment may be checked very simply and precisely by rotating the instrument 180 degrees.

The Gurley Shifting Head Tripod permits 1¾" movement of the transit in two directions 90° separated, without material disturbance to the level of the plate (the Optical Plummet thus remains operative through the entire centering procedure).

Advantages of the Gurley Optical Plummet Transit

- Saving in set-up time, as much as 33%—a factor when a crew is waiting.
- Eliminates swaying plumb bob.
- More accurate centering over point.
- On construction work—sights on points some distance below, such as encountered in bridge work and building construction.
- Made in U.S.A.—Little servicing, but easily repaired when necessary.

Gurley Optical Plummet Transits Available in 21 Combinations

With Circular Compass	With Trough Compass	Without Compass
OP-52	—	OP-57
OP-62	—	OP-67
OP-132	OP TC 137	OP-137

And with limb reading to 1 min.; or 30 sec., or 20 sec....Stiff-leg or Extension-leg Tripods with Constant-Level Shifting Head and wide-frame European-type construction.

Variable Power is standard on Gurley Transits and Levels:

- Wide range of magnification with **one** eyepiece—zooms for near or distant objects
- Easily adjusts to suit weather and light conditions
- Built-in haze filter

At high power:
- longer shots
- less glare in bright sunlight
- increase in readability
- no glare...high contrast
- blacks and whites stand out

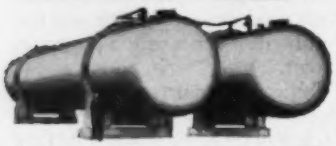
At low power:
- greater field
- brighter field
- decrease of heat waves

We will be pleased to send you further information about both Gurley Optical Plummet Transits and Gurley Variable Power Eyepiece.

W. & L. E. Gurley · 518 Fulton St., Troy, N.Y.

POSEY

TANKS AND PRESSURE VESSELS



Large capacity vessels and tanks of mild, stainless, or alloy clad steel for petrochemical, butane, petroleum, and pulp industries.

For FREE 16-page illustrated catalog showing many installations, write:

POSEY IRON WORKS INC

Custom Fabrication For Over 50 Years

DIVISIONS:
• Iroquois Asphalt Plants • Mixers and Blenders
• Tunnel Forms • Industrial Heating • Foundry
• Large OD Steel pipe

102 South Street LANCASTER, PA.

CATALOG DIGESTS

140 SOIL TESTING EQUIPMENT

Testlab Corp.—This brochure describes a field and laboratory unconfined compression tester that is hydraulically operated. The tester is completely self-contained as it requires no outside energy source. Capacity is 1,000 lb. Also described are 2 sizes of automatic reflux asphalt extractors used to determine percent of bitumin in asphalt.

141 SEISMIC EXPLORATION

Geophysical Specialties Company—This illustrated 8-page brochure explains the techniques of seismic exploration using the self-contained portable MD-1 Engineering Seismograph. It includes a chart that shows ripper performance as related to seismic wave velocities and shows how seismic analysis protects profits on jobs based on firm bids by indicating depth of overburden, rippability of rock and depth to bedrock.

142 SOIL TESTING DEVICE

Charles R. Watts Co.—Full information is offered on the Washington Dens-O-Meter, developed by soils engineers of the Department of Highway, State of Washington. Now in use throughout the world for making field density and moisture tests in a wide range of soils, it is accurate and fast in small or large holes 3 ft deep in fine, coarse, granular base and gravels.

143 GRADATION EQUIPMENT

Testlab Corp.—This 4-page brochure describes equipment commonly used in running gradation tests. Featured in this brochure is a new sieve shaker called the TESTshaker, which is designed for either field or laboratory and can efficiently shake either 8 or 12 in. dia nested sieves.

PLEASE PRINT NAME CLEARLY

Storage Vessels

144 STEEL PLATE CONSTRUCTION

Graver Tank & Mfg. Co.—The current issue of the ECHO, employee magazine of this company, includes several interesting case histories of field-construction. Featured is an article describing the erection of large liquid oxygen and liquid nitrogen vessels.

145 HORTON FLOATING ROOFS

Chicago Bridge & Iron Company—A 24-page brochure tells of proper storage containers for volatile liquids which can cut evaporation loss by 94 percent. The brochure describes features of double deck pontoon and pan types of floating roofs along with metallic and fabric sealing devices.

146 ASPHALT LINING—PREFABRICATED

Gulf-Seal Corp.—The fourth edition of the Engineering Brochure presents dependable prefabricated asphalt lining. Included are installation details, specifications and photographs of numerous installations. The tough, flexible lining solves many problems involved with the storage of industrial salt water and waste chemicals, municipal treated and untreated water, and in restoring to efficient service steel and concrete reservoirs.

147 REFRIGERATED STORAGE FACILITIES

Chicago Bridge & Iron Company—This 8-page brochure describes the design and function of facilities for the storage of liquefied gases between +32 deg F and −50 deg F. The brochure points up economy and safety as well as other inherit features of low temperature storage.

148 ELEVATED TANKS

Pittsburgh-Des Moines Steel Co.—Details of the several different types of elevated steel tanks, including capacity, ranges, tank dimensions, and other factors to be considered in the selection of storage tanks. Also available, 4 pages of pictures and discussion about flat bottom water storage.

149 CRYOGENIC STORAGE VESSELS

Chicago Bridge & Iron Company—This 16-page brochure describes design of double wall-storage vessels, their refrigerating systems and accessories. Illustrations include drawings and photographs of several cryogenic storage facilities.

Surveying Equipment

150 THE MARK-FOUR GEODIMETER

AGA Corp. of America—A special report presented by Mr. James D. Carter, President of Carter Electronic Surveys, Inc., describes in detail, operating use of the Model 4 Geodimeter in the field including various schematic diagrams.

151 INVAR SUBTENSE BAR

Kern Instruments, Inc.—The Invar Subtense Bar has a temperature compensator which eliminates the need for temperature correction when ambient temperature differs widely from temperature at which the bar was calibrated. A pamphlet describing this bar and its operation in detail is now available.

152 SELF-LEVELLING LEVELS

Texas-Asiatic Import Company—This folder describes the Filotecnica Salmoiraghi automatic levels. The engineers model 5173 and the first-order model 5190, level the line of sight within 2 seconds and 3/10 of one second respectively. Other features include 10' bulls-eye vial visible in telescope field, dual purpose metal case, and simplified crosswire adjustment.

153 TRANSIT

Keuffel & Esser Company—A color, six-page brochure describes the new Paragon Transit with six exclusive features including a fully achromatic, completely enclosed optical system. It provides true angle readings and is equipped with a two speed tangent screw permitting both rough and fine adjustment from one point.

NEW PORTABLE PAVEMENT DRILL BY ACKER

SPEEDS HIGHWAY CORE TESTING

65 CORES A DAY WITH HIGH SPEED ACKER DIAMOND BIT

• Full 360° angle drilling
• Hydraulically operated leveling jacks
• Adjustable core barrel guide
• Integral pump and 100 gallon water tank

In routine operation, Acker's new highway test core drill using special Acker thin-wall diamond bits is producing 65 or more quality test cores per 8 hour shift.

Trailer mounted for portability, this new rig features a 100 gallon water tank and pump; a new built-in core barrel guide that saves time; hydraulic leveling jacks that simultaneously level the rig regardless of road contour; and dozens of valuable, exclusive features.

Write today for Bulletin 32CE

ACKER DRILL CO., Inc. P.O. BOX 830 SCRANTON 2, PA.

Over 40 years of experience manufacturing a complete line of diamond and shot core drills, accessories and equipment.

154 THEODOLITES

Keuffel & Esser Co.—Three new theodolites, with seven major features engineered for American practice, are described in the 16-page catalog "Theodolites." Detailed are the KE-2, KE-1 and KE-6e; 1-sec, 20-sec and 1-min theodolites, respectively. Full details are given on the automatic indexing of vertical circle, choice of erected or inverted image, leveling head joint system, control knobs located on one side, simultaneous viewing of both circles, optical plummet built into alidade and fully interchangeable accessories.

155 FIELD EQUIPMENT

Warren-Knight Co.—The Warren-Knight Catalogue, Part I, of Engineering Field Equipment (24 pages) has been revised and reprinted and is now available. This book includes photographs and descriptions of standard field equipment and supplies including Builder's Instruments, Compasses, Measuring Tapes, and practically everything needed for the Engineer and Builder for field use. Paragraphs pertaining to instrument care and repair are included. Part II with a complete description of drafting equipment and supplies (48 pages) including everything needed for the drafting room is also available for free distribution.

156 GEODIMETER SYSTEM

AGA Corp. of America—presents an 8-page catalog, describing the complete Geodimeter System including Model 2, 3 and 4 with reflex units.

157 AUTOCENTERING TRIPOD

Kern Instruments Inc.—The tripod allows the interchange of instruments, targets and other equipment in such a manner that centering is maintained automatically and with high precision. The tripod does three things simultaneously: it centers the instrument over the station point, roughly levels the tripod head, and gives the instrument height above the station point.

158 POCKET TRANSIT

William Ainsworth & Sons, Inc.—Information is available on the Brunton Pocket Transit, which is widely used for reconnaissance and preliminary surveying on the surface and underground, for taking topography, and for geological field work. In addition to taking horizontal and vertical angles, it may be used as a prismatic compass, level, clinometer, plumb or alidade. Essentially the transit is a magnetic needle set in an accurately graduated circle in a case which opens into a versatile sighting arrangement. A level is attached to a vernier for reading vertical angles.

159 CONTRACTORS TRANSIT

Warren-Knight Co.—An all new, American made Contractors Transit, constructed entirely of brass and bronze with special steel double center and clamps and tangent screws, is described in this brochure. Features of the transit include: internal focusing 24x power telescope with clamp and tangent screw and full vertical circle reading to single minutes; horizontal circle and vernier reading to single minutes. The instrument is complete with wide frame tripod, newly designed hardwood carrying case and accessories.

160 LEVEL FOR TRANSMISSION LINE CHECK

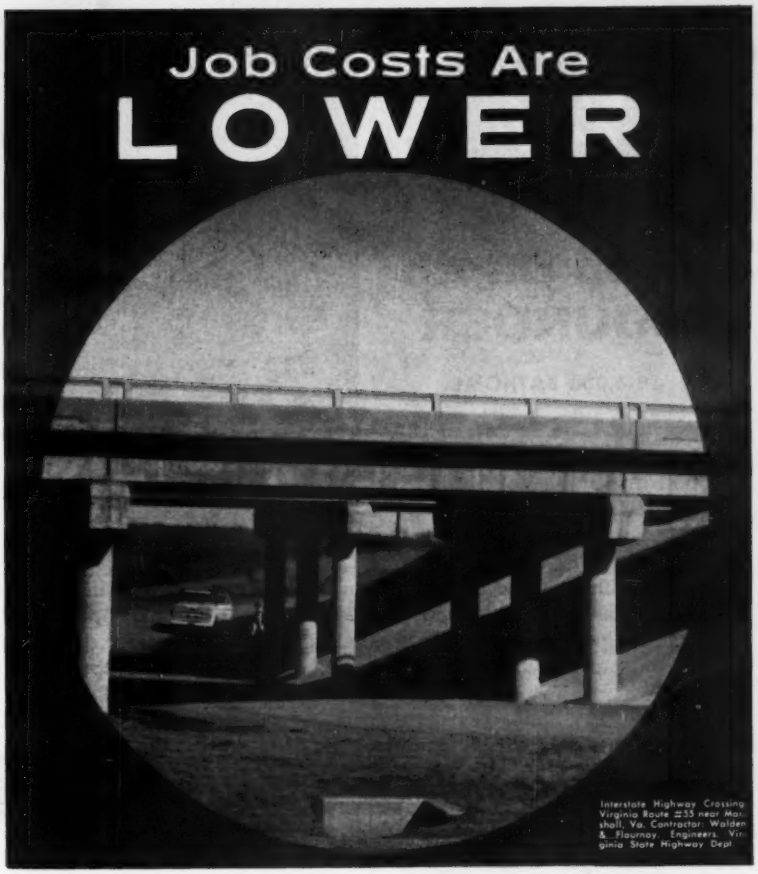
Kern Instruments Inc.—A brochure entitled "Better Way to Check Transmission Line Sag" describes the uses of Level GK1 with a special, adjustable bracket. This combination reduces errors, makes sagging operation safer and overcomes other disadvantages of older levels and mounting arrangements.

161 SURVEYING INSTRUMENTS

W. & L. E. Gurley—The complete line of Gurley surveying and engineering instruments, including transits, levels, alidades, are described in the revised edition of Catalog 50. Transits described include the Hall Gate Precise Transit; Standard Precise Transit; Gurley Telescopic Solar Transit; Standard Precise Mining Transit; Optoplane Precise Transit for industrial use; Optical Plummet Transit. Included are cross-sectional drawings of many of the transits.

162 SURVEYING INSTRUMENTS

Fennel Instrument Corp. of America—A 12-page catalog is now available covering a complete line of surveying instruments in both American and European styles. Included are self-leveling levels, optical plummet transits, standard 5¼ and 6¼ in. transits, and 1 min and 1 sec theodolites.


Job Costs Are
LOWER
Interstate Highway Crossing Virginia Route #55 near Marshall, Va. Contractor: Walden & Flournoy. Engineers: Virginia State Highway Dept.

when you form round concrete columns with

SONOCO

***Sonotube*®**

FIBRE FORMS

In overpasses, buildings or any structure, SONOTUBE Fibre Forms save time, labor *and money* in forming round concrete columns.

These lightweight, one-time-use forms can be placed, braced, poured and stripped quickly by semi-skilled labor. There's no fabrication, no assembly, no dismantling, cleaning, re-oiling or return shipping either!

SONOTUBE Fibre Forms are unmatched for on-the-job adaptability. They can be easily sawed for tie-in with wall or beam forms, punched for anchor bolts or dowel rods, and cut for utility outlets. For all types of round, half-round, quarter-round, or obround columns and pilasters, use SONOTUBE Fibre Forms — the fastest, most economical forming method for round columns of concrete!

Available 6" to 48" I.D., in several types to meet various job requirements. Order SONOTUBE Fibre Forms in standard 18' lengths or specified lengths.

See us in Booths 51-52 ASCE Show, October 16-20

See our catalog in Sweet's.

For complete information and prices, write

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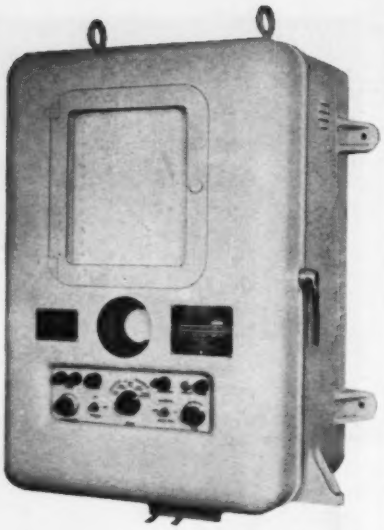
Edo

Deep Depth SOUNDER

0-6,000 FATHOMS



AN/UQN-1D. Edo Model 185 Deep Depth Sounder, developed originally for the U.S. Navy, is now in quantity use by the U.S. and other navies as well as commercially. Unit gives clear CRT indication of depth in two scales, 0-100 feet and 0-100 fathoms; records continuously in three scales, 0-600 feet, 0-600 fathoms, 0-6000 fathoms. No comparable sonar equipment has ever been manufactured in such large quantities and put to such universal use. For brochure, write Dept. V-3.

SINCE 1925 **Edo CORPORATION** College Point 56, L. I., N. Y.

The PRUYN POINT, made of high carbon steel, is tough and strong enough to withstand all obstructions in the hardest soil.

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HEADQUARTERS for all Pile Fittings — *Brochure on request*

ASSOCIATED PIPE & FITTING CO., INC.

262 Rutherford Blvd., Clifton, N. J.

163 L-E-VATION ROD

Lenker Mfg. Co.—A brochure is offered on a new designed leveling rod on which all elevations are read direct. All computations are eliminated. Measurements are given in feet and tenths or in the metric system.

164 OPTICAL PLUMMET

Warren-Knight Co.—The Warren-Knight Optical Plummet, known as the Tele-Plumb, is exclusive in that it is fastened to the end of the Transit or Transit-Level telescope and the sight to the tack beneath the instrument is made with the full power of the main telescope. The Tele-Plumb pamphlet gives complete information on this optical plummet which saves time in setting up accurately and without the use of a Plumb Bob. The Tele-Plumb is attached permanently and the instrument can be used for regular service without removing the Tele-Plumb.

165 OPTICAL PLANIMETERS

Texas-Asiatic Import Co.—This folder describes the Filotecnica Salmoiraghi planimeters. They are characterized by having a large optical tracer lens instead of a stylus, automatic zero reset, tracer arm graduated in true vernier units, and full enclosure for shock and dust protection.

166 THEODOLITES

Kern Instruments Inc.—A catalog describes the most modern theodolites produced by Swiss precision engineering and workmanship, and contains complete technicial information. Descriptions of field applications and circle readings are also included for each instrument.

167 TRANSITS AND DUMPY LEVELS

Texas-Asiatic Import Co.—This literature describes the Eagle 6-in. Standard Transits (20-sec and 1-min horizontal verniers), which are made of solid bronze, with a unique 11-piece optical system and several refinements not found on any other instrument. It also describes the Eagle Engineer's Dumpy Levels, which are available in both an 18-in. and 15-in. model.

CATALOG DIGESTS

168 SPECIAL PURPOSE INSTRUMENTS

Warren-Knight Co.—Folder SP illustrating and describing the company's special purpose instruments including Sight Clinometers, Precision Vernier Clinometers, Precision 3-arm Protractors, 15-deg Precision Quadrant Levels, 180-deg Variable Setting Clinometers, 110-deg Precision Quadrant Levels, Precise Mounted Levels and Precise Prismatic Reading Levels, is now available. The bulletin also includes information pertaining to mounted and unmounted level vials with illustrations of three frame types, with dimensions, sensitivities and prices.

169 GEODIMETER USES

AGA Corp. of America—A bi-monthly bulletin describes various field uses of the Geodimeter, available on request and free of charge.

170 SELF-LEVELING LEVEL

THS Company—The new automatic level with spherical head, quick-setting tripod is described in an 8-page folder. Also included is data on THS Transits, Transit-Levels, Dumpy Levels, Tilting Levels, Hand Levels and other instruments and accessories.

Water & Pollution Control

171 PACKAGE SEWAGE TREATMENT PLANTS

Walker Process Equipment Inc.—Sparjair units range in capacities from 50 to 5000 pop. equiv. to offer complete treatment plants for housing developments, motels, shopping centers, etc. This package type plant produces a clear, nuisance free effluent through the contact stabilization process. Theory, operation, design factors, specifications and details are covered in bulletin 19-S-94.

172 SEEPAGE & POLLUTION CONTROL

Gulf-Seal Corp.—The fourth edition of this brochure explains in detail how cities and industries overcame difficult problems in seepage and pollution by using flexible asphalt sheets in drinking water reservoirs, salt water pits, canals and industrial waterways. The brochure is illustrated with detailed step-by-step photos.

173 DIGESTER CIRCULATING-MIXING EQUIPMENT

Walker Process Equipment Inc.—The Gaslifter is an exclusive development for circulating and mixing digester contents. Grease and scum blankets and bottom deposits are eliminated resulting in increased digester efficiency and capacity. The Gaslifter utilizes digester gas, through the air lift principle to effect the circulation action. Bulletin 25-S-91 furnishes details and photos of installations.

174 SEWAGE TREATMENT

Yeomans Brothers Company—Information on small sewage treatment plants are presented in bulletin 1510. It lists ten sizes from 3,000 to 18,000 gal per day as well as application design data on institutional, commercial, small factory, subdivision and municipal use. Cross-section drawings and text explain the construction and operation of a complete small plant.

175 DIGESTER SLUDGE HEATING EQUIPMENT

Walker Process Equipment Inc.—The Heatx for digester sludge heating is presented in Bulletin 24-S-82. Designed specifically for sludge heating the Heatx features a custom burner and heat exchanger combined with a separate boiler to furnish the most efficient system available. The units operate on digester gas with automatic switchover to either natural gas or oil for auxilliary fuel. Capacities range from 110,000 to one million btu/hr.

176 WATER FACILITIES—IMPROVEMENT OF

Cast Iron Pipe Research Association—By writing on their business letterhead, engineers concerned with water utilities may have a copy of this association's book "Water—Make Sure You'll Always Have Plenty." Prepared to acquaint civic leaders with the seriousness of the community water problem, it gives a step-by-step outline of what citizens can do to help improve community water facilities by working with water utility executives.

177 SEWAGE STATIONS

Smith & Loveless—A 16-page brochure has just been released, describing factory-built sewage lift stations and "Oxigest" sewage treatment plants. The bulletin describes the design features and operation characteristics of sewage pump stations, pneumatic ejector lift stations and equipment, comminutors, and both factory-built and field-erected "Oxigest" sewage treatment plants.

178 WATER, SEWAGE AND WASTE

Walker Process Equipment Inc.—Bulletin G-50 has been prepared to present equipment for water, sewage and waste treatment. It includes a brief description and illustrations of a wide variety of sanitary engineering equipment.

179 FILTERS

Anthracite Equipment Corp.—The free catalog, "Anthrafilt Hard Coal Filter Medium" gives complete technical data on the sizes and uses of "Anthrafilt" as a filter medium for municipal and industrial filters. It outlines the advantages of "Anthrafilt" over sand as a filter medium.

180 SLUDGE REMOVAL

Walker Process Equipment Inc.—Circular collectors for sludge removal are presented in bulletin 9-W-65. It describes both standard and special designs; including tractor (peripheral) drive units, multidraw (suction nozzle) collectors and special clarification units.

Technical Books

181 CIVIL ENGINEERING BOOKS

John Wiley & Sons—An extensive 1961 catalog includes lengthy list of civil engineering books and titles in related areas.

182 CIVIL ENGINEERING BOOKS

The Ronald Press Company—offers a package of circulars on books for civil engineers. Subjects covered include: air conditioning, soils engineering, substructure analysis and design, structural design in metals, statically indeterminate structures, prestressed concrete design and construction, nondestructive testing, transverse vibration theory, tensor analysis and principles of engineering economy.

183 TECHNICAL BOOKS CATALOG

F. W. Dodge Corporation—A 24-page illustrated catalog listing books on engineering, architecture, construction and allied fields is now available. Included are books on general excavation, the design of prestressed concrete beams, elementary statics of shells, timber design and construction, the design of structural members, and applied structural design of building.

184 TECHNICAL DATA BOOKS

Lefax Publishers—announces a revised catalog for 1961 of Pocket Size Technical Data Books. Condensed, comprehensive, authoritative, these handy books cover every branch of engineering and are of use to engineers, technical men, surveyors, teachers and students.

185 CIVIL ENGINEERING SUPPLEMENT

McGraw-Hill Book Company—offers a Civil Engineering Supplement available for distribution. It lists many books on the following subjects: Surveying; Construction Methods and Costs; Soil Mechanics; Foundations; Structural Engineering; Graphic Statics; Plain Concrete, Reinforced Concrete; Transportation Engineering; Highway Engineering; Photogrammetry and Aerial Photographic Interpretation; Hydraulic Engineering; Sanitary Engineering; Orientation and Engineering Problems for Engineers; Engineering Sciences; Engineering Instruction; Law & Ethics and Engineering Economics.

Return the coupon today!

Waterproofing

186 WATERSTOP—NON-MELTABLE MASTIC

Sika Chemical Corporation—A catalog is offered on Igas Joint Sealer, to seal joints and cracks between concrete masonry and steel durably. It is for use in basements, reservoirs, swimming pools, tanks, tunnels and parking decks. It also may be used for flexible watertight membrane coating. The brochure includes joint design details.

187 CONCRETE WATERSTOPS

Water Seals, Inc.—Labyrinth Waterstops are manufactured of polyvinyl plastic, which helps maintain a constant, strong, watertight bond between concrete joints. A catalog describes the convenient features of Labyrinth Waterstops, including those which render it resistant to age, chemical and weathering changes. Blueprint type specification drawings include the Labyrinth, Flextrip, Cellular and Dumbbell waterstops in their various sizes. A table lists the recommended joint application and water head for each size and kind of waterstop.

188 VAPOR SEAL

W. R. Meadows, Inc.—This booklet fully explains in a direct and easy to understand manner, the cause and effect of destructive moisture, the need for a true vapor seal and how "Premoulded Membrane" meets this need. The booklet covers architectural and engineering data, technical information, various applications and specifications.

189 STRUCTURAL SEALANTS

Adhesive Engineering—A 4-page data sheet is available covering Ad-Seal synthetic rubber sealants. A full description is given of types, consistencies, performance and procedure for use. The two-part compounds are used for contraction, expansion and control joints in reservoirs, swimming pools and many types of structures.

Turn to page 130 and order your literature.

190 PAPER-WATERPROOF

Keuffel & Esser Co.—A 4-page brochure describing a weatherproof field book that permits permanent records to be made in rain and excessive humidity is now available. Known as "Rite in the Rain", this paper is said never to warp, wrinkle or soak up moisture and can be written on while the surface is wet.

CENTRILINE

grants NEW LIFE to old pipelines of 4" to 144" in diameter

HOW CENTRILINE HELPS • By giving a uniform cement-mortar lining to old pipes—**in place**—Centriline produces these benefits: • Stops corrosion and tuberculation permanently • Prevents all leakage • Permanently establishes highest hydraulic capacity.

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HOW CENTRILINE WORKS • After pipe is cleaned, machines apply cement-mortar to the inside walls. In larger pipe sizes, automatic trowels smooth lining to uniform thickness, determined by the speed of the machine. Centriline offers complete contract service.

PIPE RECONDITIONING FOR ALL SIZES

4"-14": Machine slides past corporation cocks and laterals without excavation. For small mains, fire lines, distribution grids. About 500 feet between openings.

16"-22": Self-propelled machine with automatic trowelling attachments. About 800 feet between openings.

24"-144": Operator drives machine through pipe. Lining trowelled to smooth finish. About 1200-1800 feet between openings.

For further information, send for our illustrated brochure.

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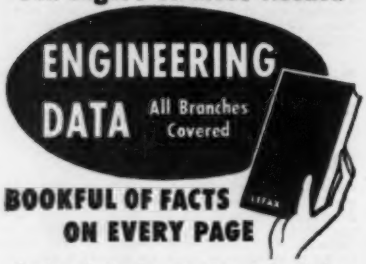

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CATALOG DIGESTS

191 WATERSTOP MANUAL

W. R. Meadows, Inc.—The availability of a manual on "Sealtight" PVC Waterstops has been announced. It describes applications, installation information, product specifications and engineering data, and gives complete range of product sizes and types.

192 STRUCTURAL SEALING

Thiokol Chemical Corporation—A 12-page brochure, No. SS200, describes uses of LP polysulfide polymer base compounds for sealing all types of structural joints. Instructions are given for mixing, applying, surface preparation and tooling. A comparison with other types of sealing materials and their costs is also included.

193 WATER SEALER

E. A. Thompson Co., Inc.—This sealer is composed of several organic and mineral-organic compounds which are polymerized and carried in an aromatic solvent. It penetrates into the surface, carrying solids right into the pores where expansion takes place. Bulletin A.I.A. 7-A gives specifications and a complete application guide.

Welding

194 WELDING EQUIPMENT

Hobart Brothers Co.—Catalogs and bulletins: EW-250 Arch Welder Catalog, covers the complete line of manual, semiautomatic and automatic welding machines; EQ-216 Electrode Catalog, covers the complete line of arc welding electrodes; EW-267 Accessories Catalog covers the complete line of welding accessories.

Return the coupon today!

195 OVERLAY WELDING

Chicago Bridge & Iron Company—offers a 4-page brochure discussing overlay welding. This process provides increased protection against corrosion and erosion in vessels designed for high pressure service.

196 STRUCTURAL WELDING PRACTICE

Saxe Welded Connections—Steel beam and column connection clips and seats, their numerous uses and applications are thoroughly discussed in this 74-page manual. Also included are complete comparative cost studies and all information required to design a welded structure.

Wellpoints

197 DEWATERED PROJECTS

Moretrench Corp.—Pictured in this new 64-page catalog are various types of dewatered projects. The catalog gives factual descriptions of pumping problems successfully handled by this company's wellpoint equipment. There is also a list of brochures available for detailed information on key parts of pumping equipment.

198 WELLPOINT DEWATERING

Griffin Wellpoint Corporation—"The Griffin Wellpoint System"—32-page digest showing a wide variety of wet jobs, many of which present unusual dewatering problems, is now available.

199 WELLPOINTS

Moretrench Corporation—A 4-page bulletin illustrating and describing standard and special types of Moretrench Wellpoints and their use in various types of jobs has been made available.

200 WATER WELL CASING

Thompson Pipe & Steel Co.—Water well casing, made of mild or stainless steels, is made with a choice of 5 perforations to suit all soil and corrosion conditions. Many accessories and field joints from which to choose are included in catalog B-15-B.

There are 225 Digest items on pages numbered 130 to 160. Read all items for the literature of interest to you.

Miscellaneous

201 DESIGN MANUAL

W. R. Meadows, Inc.—has prepared a manual entitled "Design Techniques for Controlling Moisture in Building Structures." This manual, prepared by a firm of technical engineering writers, was originally planned to sell for $1.00 per copy. However, as this problem is of vital interest to all in the construction industry, this company will now send a free copy to all architects, engineers and builders who desire a copy for their file.

202 GEAR DRIVES

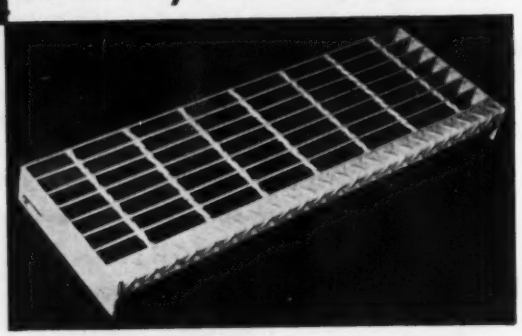
Johnson Gear & Mfg. Co., Ltd.—Catalogs 31 and 32 contain engineering data on hollow and solid shaft gear drives for use in pump and industrial applications. Standard combination drives are listed in a wide range of models and ratios including the new automatic Redi-Torq combination drive which eliminates service interruptions due to power failures.

203 BONDING AGENT

Larsen Products Corporation—Weld-Crete is a patented chemical bonding agent that eliminates chipping, drilling, roughening, etching or otherwise scarifying the base material. Bulletin P-461 presents test data, performance specifications, approvals and compliances, and cost estimates.

INSURE Safety Underfoot

with **Strong, Light-Weight, Self-Cleaning**



KERRIGAN Weldforged STAIR TREADS

Kerrigan's standard tread with Super-Diamond Nosing (illustrated) gives maximum visibility and underfoot safety where needed most.
Increase plant safety with these easily installed treads.
Send now for new, easy-to-use steel grating and tread catalogs.

KERRIGAN IRON WORKS COMPANY
Nashville, Tennessee

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CATALOG DIGESTS

204 ROLLING DOORS

Kinnear Manufacturing Co.—According to this catalog #109, these rolling doors meet nine major requirements: "Registered" life extension; quick, easy operation; space saving; greater durability; fire protection; maximum safety; general protection; neat appearance; and economical installation. Steel rolling service doors, steel rolling fire doors, and bifold doors are a few of the rolling doors discussed in the catalog. Also included are specifications, photographs and an index to door types.

205 SLIDE RULES

Keuffel & Esser Co.—The scales, functions and limitations, as well as a description, of standard slide rules are offered in this 24-page catalog. In addition, pictures and specifications of K&E's full line of slide rules in mahogany and plastic are presented, ranging from general purpose to special purpose, Decitrig to Mannheim, standard to pocket sizes. Not an instruction booklet, the catalog serves as a general introduction to the use of slide rules.

206 PULLEYS

Stephens-Adamson Mfg. Co.—One piece, all steel "spun-end" construction eliminates welding and material build-up on this Curve Crown pulley. The squeeze lock hub effectively transfers loads from rim to hub and from hub to shaft. Bulletin 1160 gives a full description of these pulleys with a load rating chart and dimensions and weights.

207 SAND SEPARATORS

Equipment Engineers—The Krebs Centrifugal Sand Separating System is fully described and illustrated in a catalog now available. The principle of operation, specifications for the sand separators and operating results, are also included.

208 STEEL GRANDSTANDS

Pittsburgh-Des Moines Steel Company—A 4-page illustrated folder thoroughly describes construction, design factors, seat spacing, aisle width, specification check points and over-all advantages of these permanent stands for outdoor seating. Formulas for calculating seating capacities are provided, and capacity tables. Types of stands pictured include school, racetrack, baseball and fairground structures. Unit construction and adaptability are features of PDM Steel Grandstands.

209 ALUMINUM LIGHTING

Kerrigan Iron Works Co.—Full data catalog on new line of seamless, round tapered aluminum lighting standards for street, highway and area lighting. Wide variety of styles, includes traffic signal standards, brackets and mast arms.

210 SPACE SIMULATION FACILITIES

Chicago Bridge & Iron Company—The facilities for aircraft, missile and human factor research are described in a 4-page bulletin. The publication points up CB&I's ability to take full responsibility for environmental test facilities from design through start up.

211 TRACKS

American Bitumuls & Asphalt Company—A booklet on an approach to construction of oval tracks for track meets has been announced. This Grasstex Track (proved at the University of Florida) offers low initial cost; very low maintenance; year-round utility; and fine performance experience.

212 HIGH STRENGTH BOLTS

Russell, Burdsall & Ward Bolt and Nut Co.—Savings of up to 40% in bearing-type connections can be achieved through the use of a new high strength bolt described in this 8-page reference bulletin. The larger head and shorter thread length of the new bolt design offer substantial advantages: for erectors, savings in fastening time and materials cost; for fabricators, faster and less expensive production; for designers, specified shear strength with reduced number of bolts. Contains useful specifying information.

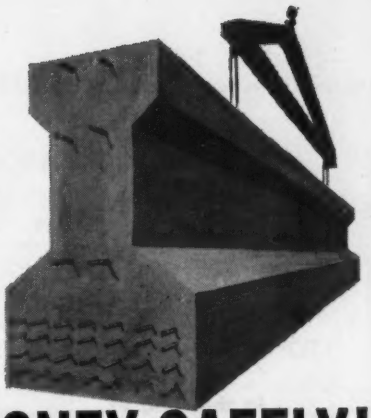
213 ROOF MEMBERS

Macomber, Inc.—Now available is a 32-page design manual on new framing members called V-Purlins. Design information, deflection calculations, dimensions, load tables and bridging information are combined with general construction details for spans to 120 feet.

Dependable

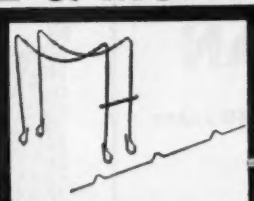
Richmond

products for prestressed concrete



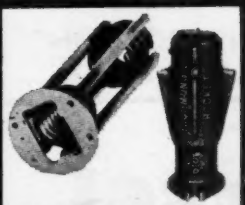
SAVE TIME & MONEY SAFELY!

Richmond Strand Deflection and Push Down Inserts for depressing strands. Special units can also be manufactured to suit individual needs.

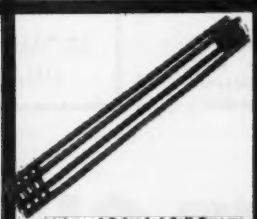


Richmond Chairs and Spacers for void supports and spirals in prestressed piles and beams.

Richmond Inserts for connection of cast-in-place diaphrams to prestressed girders.



Richmond Inserts for anchoring to or hanging from prestressed members.



Richmond Extended Coil Tyscrus for lifting prestressed beams and girders. (2 & 4 strut)

Richmond Inserts for anchoring guard rails to prestressed girders.

Phillips Self-drilling Concrete Anchors for anchoring to any concrete members after concrete has set.

Richmond Offset Free-Fit Hanger Frame-Tys used to hang forms from prestressed "I" beams.

SWENCH—manual impact wrenches for tightening and loosening concrete forms.

Shown here are a few of the many Richmond-engineered products for the prestressed concrete construction industry. For more information about them, or help with any specific concreting problem, write to:

Richmond SCREW ANCHOR CO., INC.

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TIDE GATES

Fig. B-68, Type M
(CIRCULAR)

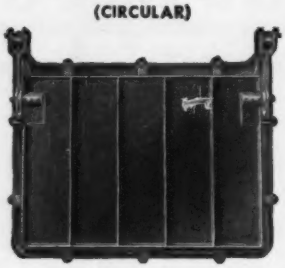


Fig. B-61, Type MM
(RECTANGULAR)

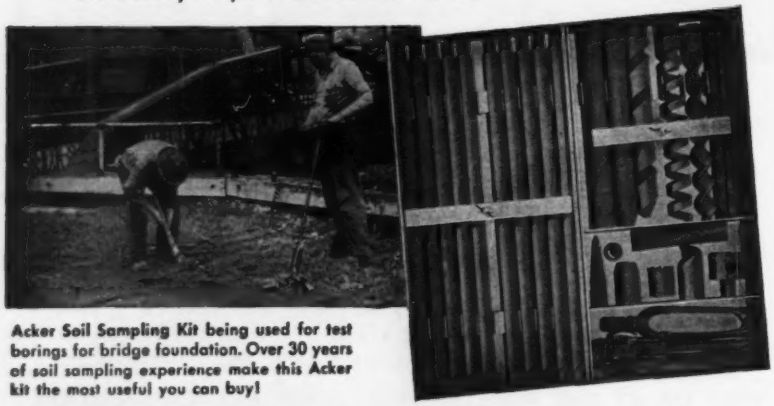
BROWN & BROWN, INC.
LIMA, OHIO, U. S. A.

DON'T GUESS!

use an ACKER SOIL SAMPLING KIT for accurate sub-surface information

With accurate sub-soil information, *you avoid* costly trouble later on. And, what better way to get this information than with a portable, easy to use Acker Soil Sampling Kit. For here is a versatile collection of twelve soil sampling tools packed in a handy steel kit that can be carried in any car.

Write today for prices and Bulletin 26. CE



Acker Soil Sampling Kit being used for test borings for bridge foundation. Over 30 years of soil sampling experience make this Acker kit the most useful you can buy!

ACKER DRILL CO., Inc. P.O Box 830 Scranton, Penna.

214 PAINT PIGMENT

Eagle-Picher Company—Makes highly effective anti-corrosive paint pigment, Basic Lead Silico Chromate, known as Permox 1-4-3. Meets approval of Federal and State Civil Engineers for both primer paints and complete painting systems. Illustrated Permox 1-4-3 book gives recommended formulations for primer, intermediate and finish coats; contains accurate color chips of available tints. Booklet free on request.

215 BOLT—HIGH TENSILE

Automatic Nut Company—A descriptive brochure on this interference body type bolt with interrupted ribs is now available. The bolt meets ASTM A-325 specifications and has been approved by foundations and institutes. It gives high clamping force as well as body-bound fit. Higher strength values permit the use of fewer bolts for certain connections.

216 COMPOSITE CONSTRUCTION

Nelson Stud Welding Div. of Gregory Industries, Inc.—A comprehensive bulletin explains what composite (concrete and steel) construction is, how it works, its various advantages and economies and how it has been used in all types of building construction.

217 FLUME TRANSMITTER

Simplex Valve & Meter Company—This 4-page bulletin, No. 726, describes the Float-in-Flume Transmitter. This device eliminates the use of stilling wells and other accessories. Also included is tabular data showing capacities, sizes and layouts.

218 COFFERDAMS

Spencer, White & Prentis, Inc.—"Cofferdams," by Lazarus White and Edmund Astley Prentis is a trusted source-book covering actual design and construction of cofferdams as well as the theoretical features. The price is $10.

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219 ENGINES—DIESEL

Allis-Chalmers Mfg. Co.—Features of the Models 10000 and 11000 diesel engines are described in the eight page catalog, BU-718. Performance curves, charts, and illustrations, including cutaways of important components are included to illustrate these two new engines in the 100-210 hp class.

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220 CONVEYOR—SECTIONAL BELT

Stephens-Adamson Mfg. Co.—Bulletin 458 is offered on the new Pre-Engineered Sectional Belt Conveyor. It features comprehensive technical data, pre-engineering advantages and an exploded view of the Sectional Belt Conveyor with all the quality components called-out.

221 ROOF STRUCTURES

Fluor Products Company—"Beauty, Utility and Economy" is the title of this 20 page brochure featuring Douglas Fir glu-lam beams and arches. Design and specification information, including load-span tables are presented.

222 FLASH VEST

Warren-Knight Company—The safety flash vest is made of a vinyl coated heavy cotton in a fluorescent orange red with contrasting luminescent white strips. Designed to fit-over any type of clothing, it is perforated for coolness and comfort. More information is available on request.

223 DESIGN MANUAL

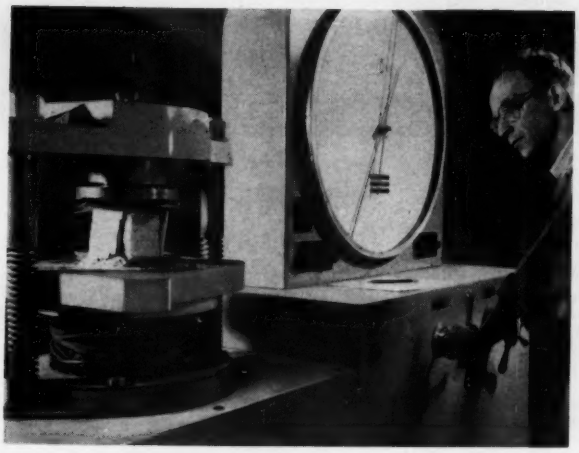
Macomber, Inc.—announces a manual of complete design information, dimensions, load tables, bridging information, construction details and specifications.

224 STAGING EQUIPMENT

Spider Staging, Inc.—Described in this 15-page booklet is the staging machine stated to replace swing stages, bosun's chairs, needle beams and kick planks. A list of rigging equipment and accessories is also included.

225 TECHNICAL SERVICES

John A. Roebling's Sons Div., The Colorado Fuel and Iron Corp.—Catalog D-933 is descriptive of the diversified products and varied technical services and facilities available from Roebling. Ideas are presented in a direct manner with details held to a minimum.



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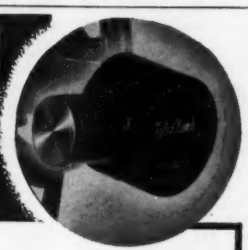

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PROCEEDINGS AVAILABLE

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Journals: City Planning, Highways, Hydraulics, Irrigation and Drainage, Professional Practice, Sanitary Engineering.

2918. Discussion of Proceedings Paper 2607, 2663, 2701, 2767. (SA) N. Claes H. Fischerstrom on 2607. Vaughn C. Behn on 2663. Thomas R. Camp on 2701. Gilbert H. Dunstan on 2767.

2919. Discussion of Proceedings Paper 2592, 2677, 2766. (HW) William H. Gotolski on 2592. I. J. Taylor on 2677. Herbert G. Bossy on 2766.

2920. Discussion of Proceedings Paper 1997, 2311, 2551, 2756, 2765, 2772, 2780, 2823. (HY) Edward N. Whitney, Joe M. Lara, and Kenneth B. Schroeder on 1997. Ronald T. McLaughlin on 2311. William Haushild and Gordon Kruse on 2551. Paul F. Keim and Vito A. Vanoni on 2576. Charles E. Behlke and James R. Steven on 2765. John Parmakian on 2772. Kenneth W. Wise on 2780. P. F. Biery and J. W. Delleur on 2823.

2921. Effect of Hydrogen Sulfide on Concrete Structures, by Bernal H. Swab. (SA) A study was made of the factors contributing to the generation of hydrogen sulfide and the resultant effect on concrete structures.

2922. Pipeline Location: Location Surveys, Progress Report, Committee on Pipeline Location. (PL) The purpose and generalized procedure of pipeline location surveys are presented, with emphasis on features of detail location and data required for design and special permits.

2923. Aqueduct Capacity Under an Optimum Benefit Policy, by Warren A. Hall. (IR) Dynamic programming is used to derive a procedure for determining the capacity required for various reaches of an aqueduct based on a policy of optimum net benefit.

2924. Hydraulic Design of Hollow-Jet Valve Stilling Basins, by G. L. Beichley and A. J. Peterka. (HY) Tests made to generalize and prove the hydraulic design of a new type of stilling basin which utilizes the hollow-jet valve for discharge control are described.

2925. Prediction of Cavitation Damage, by N. S. Govinda Rao and A. Thiruvengadam. (HY) A non-dimensional number called cavitation damage number has been proposed, based on the concept of dynamic indentations produced by short range shock-waves due to the collapse of the cavitation bubbles.

2926. Observations on Urban Transportation, by Luther Gulick. (CP) This paper presents an analysis of the interrelated economic factors involved in the design of an urban transportation system to meet the circulation demands of the urban complex.

2927. Vibration of Gates During Overflow and Underflow, by Eduard Naudascher. (HY) Model studies have been made to evaluate frequency and magnitude of the exciting forces for different types of gates and aprons.

2928. Irrigation and Drainage Studies of Texas Rivers, by Rolland F. Kaser. (IR) The U. S. Study Commission approach to comprehensive planning, involving collaboration by local, state, and federal governments, is explained.

2929. Consumptive Use and Water Waste by Phreatophytes, by Harry F. Blaney. (IR) Results of measurements of consumptive use by phreatophytes are presented.

2930. Pressures on Spillway Flip Buckets, by Armando Balloffet. (HY) Studies were made to compare the pressures on cylindrical flip buckets, both for chute and tunnels spillways, as computed by theoretical considerations and as measured in model investigations.

2931. Planning and Engineering Considerations for the Official Map, by Kurt W. Bauer. (CP) Means of making the official map a useful device for plan implementation and of providing adequate horizontal control in urban areas are considered.

2932. Relationship of Compression Ratio to Gas Pipelines, by Raymond R. Crawford. (PL) The application of the concept of low compression ratio—high mean effective pressure to the design and operation of gas transmission pipeline systems.

2933. Estimating the Probable Maximum Precipitation, by David M. Hershfield. (HY) A method for the systematic analysis of precipitation data for the purpose of estimating the probable maximum precipitation is proposed.

2934. The Terminal Shape of a Shallow Liquid Front, by E. Roy Tinney and D. L. Bassett. (HY) The equations for the shapes of long, shallow laminar and turbulent fronts advancing at constant velocity down dry open channels are derived.

2935. Free Streamline Theory for Segmental Jet Deflectors, by E. Roy Tinney, Wilfred E. Barnes, Ottis W. Rechard, and Glenn R. Ingram. (HY) Free streamline theory is applied to the determination of the exit angle of a jet of water leaving a deflector, such as a spillway flip bucket.

2936. Uniform Flow in a Shallow, Triangular Open Channel, by Richard J. Wasley. (HY) A smooth, shallow, triangular open channel was investigated to determine the characteristics of uniform flow in an idealized highway gutter.

2937. The Civil Engineer and Urban Transportation, by Jack R. Blackburn. (HW) The rapidly growing transportation problem in urban areas is pointed out. Steps are described which would contribute to a general solution of the problem.

2938. Land Use and Expressways, by Fred W. Tuemmler. (CP) Land use—expressway relationships are discussed, and various suggestions for improvement are given.

2939. Fundamentals of Cathodic Protection, by Jack W. Pierce. (PL) This paper deals with the application of cathodic protection systems in conjunction with pipeline coatings to protect and extend the life of pipelines.

2940. Adhesion in Filters, by V. Mackrle and S. Mackrle. (SA) Development of the form of the adhesion criterion and filtration equations dealing with the reductions in concentration of non-homogeneous suspensions in non-homogeneous (graded) filters is described.

2941. Refuse-Sludge Composting in Windrows and Bins, by John S. Wiley and Janet T. Spillane. (SA) Successful composting was achieved at Chandler, Ariz., in tow runs involving four windrows and twenty-five aeration bins of ground refuse and refuse-sludge mixtures.

2942. Metabolism of Organic Sulfonates by Activated Sludge, by J. M. Symons and L. A. del Valle-Rivera. (SA) Studies were conducted on eight activated sludges acclimated to four simple aromatic sulfonates and four analog aromatic corboxy compounds.

2943. Aquifer Tests on Partially Penetrating Wells, by Mahdi S. Hantush. (HY) The theory of nonsteady flow toward artesian wells partially penetrating infinite nonleaky aquifers is used to outline methods for determination of formation coefficients and thickness of water-bearing formation.

2944. Discussion of Proceedings Paper 2240. (PL) S. R. Hubbard on 2240.

2945. Discussion of Proceedings Paper 2307. (CP) Eldridge Lovelace and Ramon Duran on 2307.

2946. The Soil Drainability Factor in Land Classification, by Claude L. Fly. (IR) Drainability class boundry curves were developed, relating hydraulic conductivity and depths to impervious horizons, which reflect the capability of the land for crop growth after development.

2947. Highway Pipeline Crossing Practice: Progress Report, Committee on Pipeline Crossings. (HW) The report summarizes current pipeline-crossing practice of state highway agencies and other related topics.

2948. Factors Affecting the Safe Yield of Ground-Water Basins, by John F. Mann, Jr. (IR) The origin of the term "safe yield" is presented, as are the current definitions and concepts.

2949. Discussion of Proceedings Paper 2281, 2556, 2595, 2671, 2672, 2682, 2757, 2762, 2769. (IR) Raymond C. Richter on 2281. Committee on Sanitary Engineering Research on 2556. Paul H. Berg on 2595. Harry F. Blaney on 2671. Harold D. Hafterson and Harry F. Blaney on 2672. V. S. Aronovici and W. W. Donnan on 2757. M. Ismail on 2682. Lloyd L. Harrold on 2762. Lyman S. Willardson on 2769.

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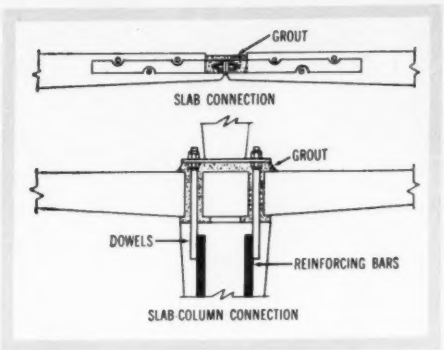

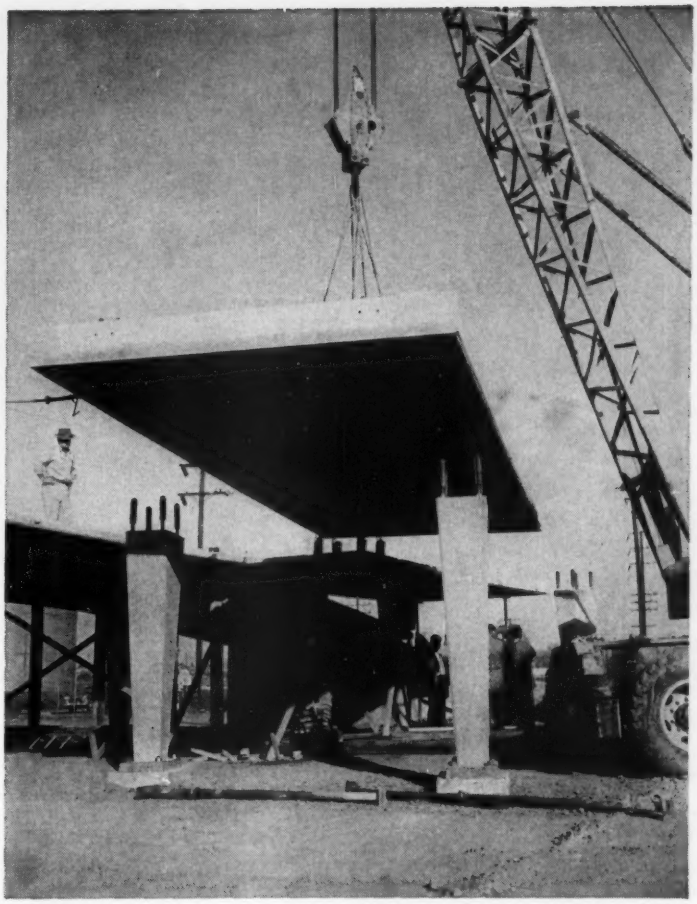

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